AGRICULTURAL CHEMICALS

One of the common clothes moths, *Tinea pellionella*, L. (After Marlatt, in Bulletin, Division of Entomology, U. S. Department of Agriculture.)

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AGRICULTURAL CHEMICALS

A Monthly Magazine For the Trade

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This photo entitled "Crop Insurance" was one of a group of prize-winners in an amateur farm photo contest sponsored by radio station WJZ, New York. The shot was taken by W. O. Mitchell, Clearfield, Pa. (Photo through courtesy of Station WJZ).

APRIL, 1947
VOL. II No. 4

In This Issue:

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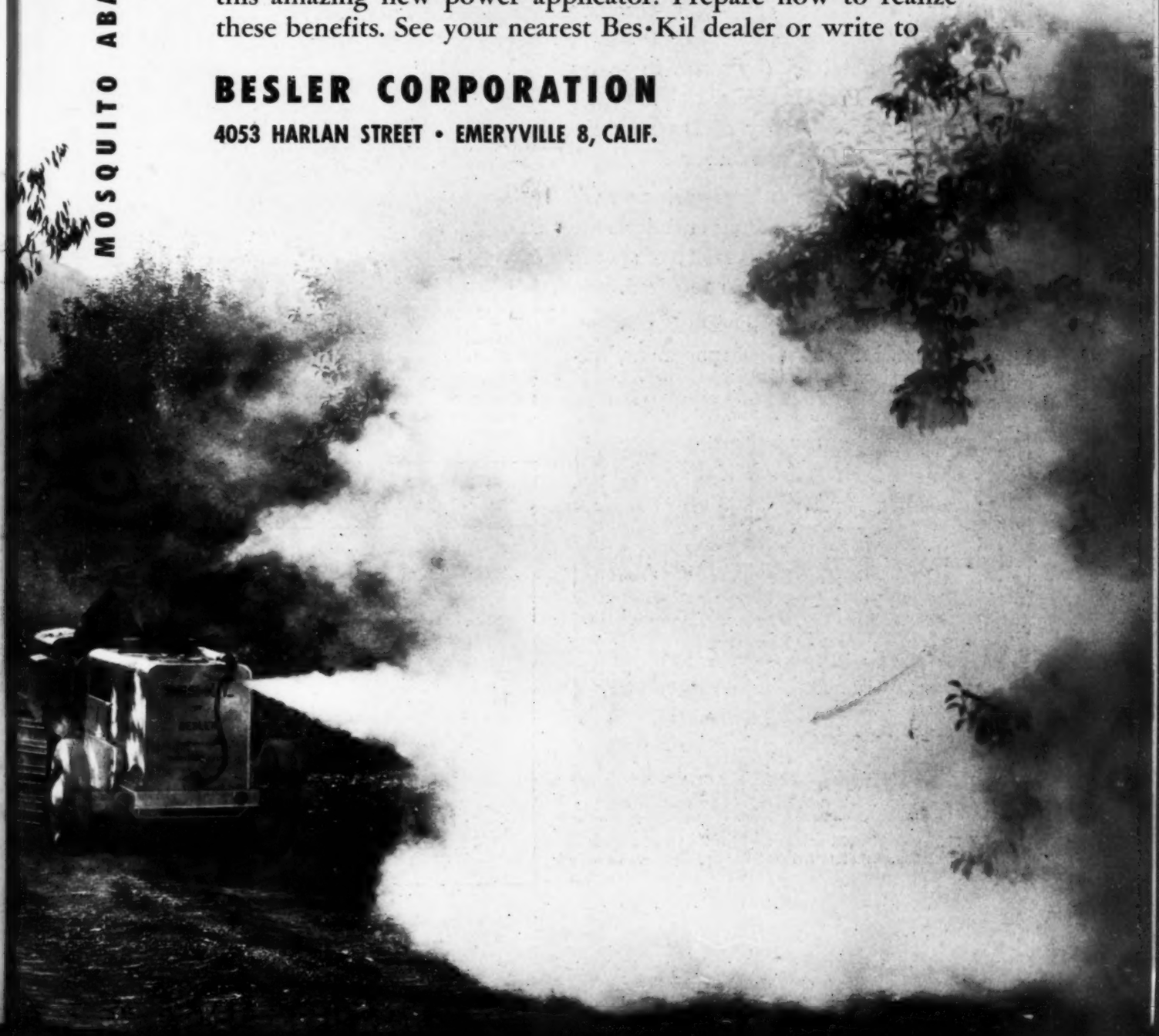

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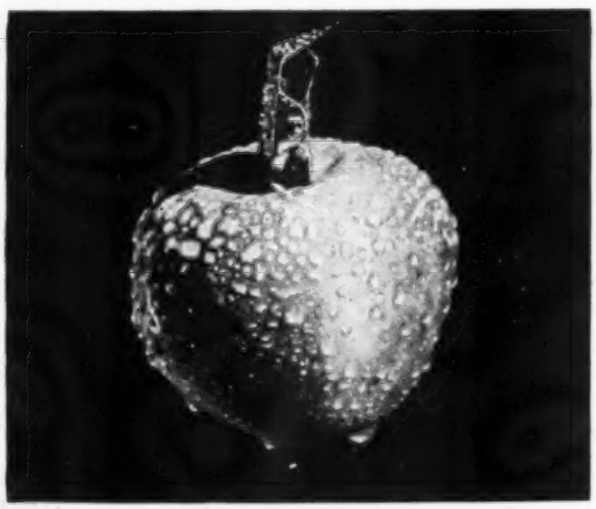

UNIFORM SPRAY COVERAGE on this apple is the result of precise Du Pont formulation. Note how the globules are distributed evenly over the apple. When dry, this fruit will be protected by a fine residue.

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Calcium Arsenate
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FERMATE* } Fungicides
COPPER-A Compound
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Bordeaux Mixtures
Lime-Sulfur
Flotation Sulfur Paste
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KRENITE* Dinitro Spray
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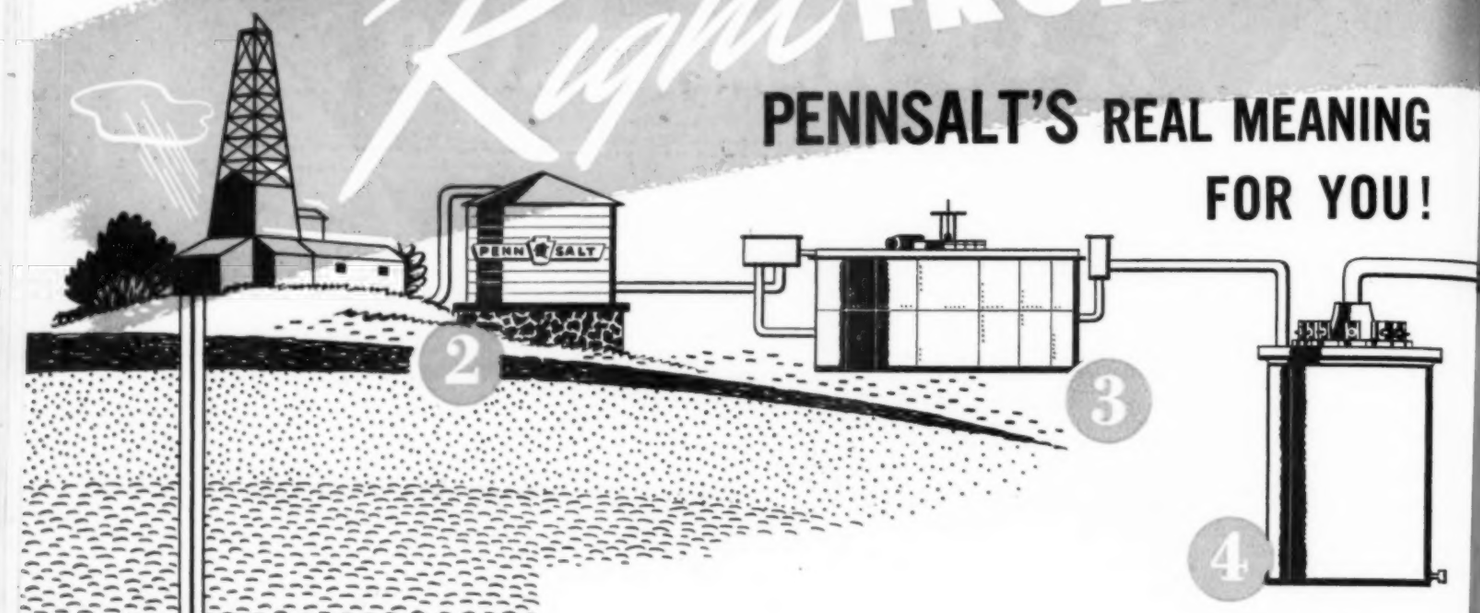

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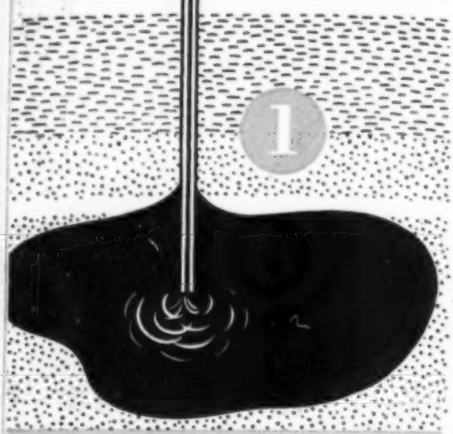

FROM THE GROUND UP Penco products stem from Pennsalt raw materials. This diagram shows how water is pumped underground into the salt deposit (1) thus forcing brine to the surface where it is stored in storage tanks (2) from which it passes through a purification system (3) thus producing pure brine for electrolysis (4).

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PRENTOX BENZENE HEXACHLORIDE will be used against cotton insects—on truck crops—against shade-tree and greenhouse pests—for protecting stored grains—on livestock—against soil-infesting insects. Household insecticides and mosquito and cockroach control operations may also find it useful.

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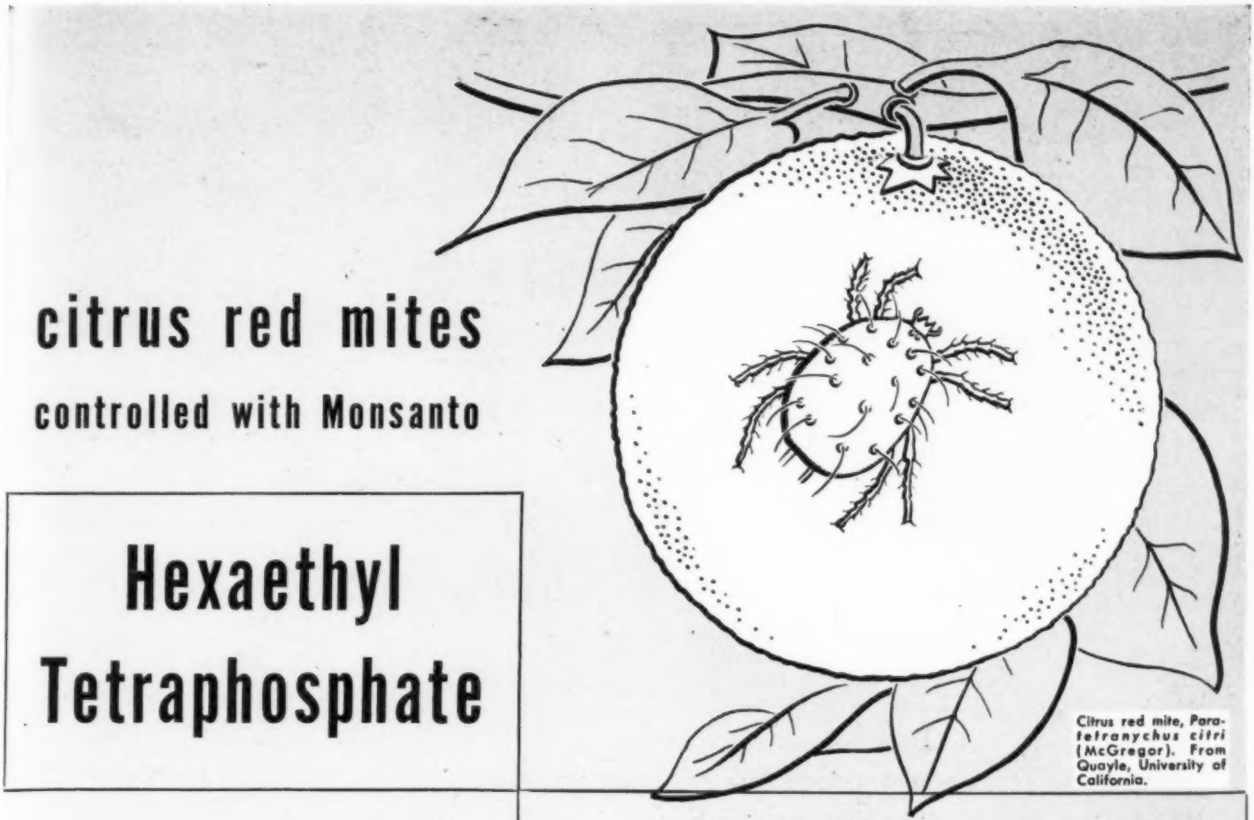

Citrus red mite, *Paratetranychus citri* (McGregor). From Quayle, University of California.

citrus red mites

controlled with Monsanto

Hexaethyl Tetraphosphate

Effective control of citrus red mites is now possible through the use of Monsanto's recently introduced Hexaethyl Tetraphosphate. Formulations of this compound also show great promise as a powerful aid in combatting numerous other insects and mites.

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OTHER INSECTS AGAINST WHICH HEXAETHYL TETRAPHOSPHATE SHOWS PROMISE

ACARINA	
Two-spotted spider mite	*Tetranychus bimaculatus* Harvey
Pacific mite	*Tetranychus pacificus* McG.
Cyclamen mite	*Tarsonemus pallidus* Banks
THYSANOPTERA	
Greenhouse thrips	*Heliothrips haemorrhoidalis* (Bouche)
HOMOPTERA	
Leafhoppers (nymphs)	Various spp.
Cotton or melon aphid	*Aphis gossypii* Glov.
Spirea aphid	*Aphis spiraecola* Patch
Cabbage aphid	*Brevicoryne brassicae* (L.)
Black pecan aphid	*Melanocallis caryaefoliae* (Davis)
Pea aphid	*Macrosiphum pisi* (Kltb.)
Rose aphid	*Macrosiphum rosae* (L.)
Chrysanthemum aphid	*Macrosiphoniella sanborni* (Gill.)
Green peach aphid	*Myzus persicae* (Sulz.)
—	*Myzus porosus* Sand.
Walnut aphid	*Chromaphis juglandicola* (Kltb.)
Mealybug	*Pseudococcus* spp.
Scale insects (crawlers)	
Soft scale	*Coccus hesperidum* L.
Citricola scale	*Coccus pseudomagnoliarum* (Kuw.)
Black scale	*Saissetia oleae* (Bern.)
LEPIDOPTERA	
Codling moth (larvae)	*Carpocapsa pomonella* (L.)
Leafrollers	Family TORTRICIDAE
Melonworm (adults and larvae)	*Diaphania hyalinata* (L.)
California oakworm	*Phryganidia californica* Pack.
DIPTERA	
Pomace fly	*Drosophila melanogaster* Meigen
House fly	*Musca domestica* L.

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HEXAETHYL TETRAPHOSPHATE

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Yes, we are proud to be among the first to supply you with HETP—hexaethyl tetraphosphate — the outstanding new chemical which shows promise as an aphicide and miticide. While there is much entomological research work yet to be done on this new insecticide, Powell is ready to supply it and ready to give you the recommendations for its use up to now.

HETP shows promise of being the most perfect miticide. Already effective control of the European Red Mite is reported with a dilution of 1-1600! It is effective for the control of Pear Psyllids at concentrations of 1-1600 and at 1-800 concentrations complete kill of nymphs and adults is obtained.

HETP is known to be highly effective for the control of most species of aphids, too, with practically complete kill accomplished two hours after application. Among the insects on its control list are Potato Flea Beetle, Cucumber Beetle, Melon Worm, Mealy Bugs, all species of Thrips and Soft Scales.

HETP will be a valuable adjunct to such insecticides as DDT and BHC. It is compatible with other commonly used products such as pyrethrum, rotenone and most of the fungicides. Its insecticidal action is principally as a contact poison. Some investigators believe it also has a fumigation action because insects not hit by the spray have been killed.

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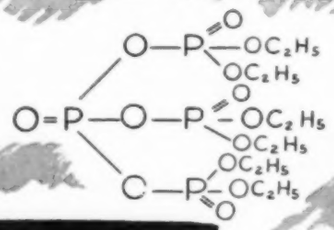

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THE EDITOR COMMENTS

THREE years of compromise effort are embodied in the Andresen Bill, otherwise the new proposed federal Insecticide and Fungicide Act, now pending in Congress. Some objections to more or less minor points of the bill have been voiced at hearings as we went to press. A few amendments have been suggested. On the whole, however, the bill appears to be satisfactory to agriculture, industry and law enforcement officials. Its chances for getting through Congress in the near future seem to be good, although there is no assurance that last-minute tinkering may not endanger its passage.

In the interest of a country-wide legislative situation now awaiting passage of this federal bill, and in the interest of uniformity and orderliness in state legislation, we sincerely hope that the Andresen Bill will pass without being hacked to pieces in the process. Amendments may come later. But right now, the country's need is a new federal law immediately. This Bill is the best answer which three years of hard work have dug up. It should be passed now.

GOVERNMENT controls over domestic allocations of nitrogen, potash and sulfuric acid have all been removed. Now, for the first time in several years, the fertilizer industry resumes the distribution of its own nitrogen and potash. It is now necessary for producers and consumers to deal with each other without governmental direction.

Heavy responsibility is thus placed on industry to solve its own problems as it can and will do. But many problems are bound to arise with the release from governmental restrictions. Shortage of raw materials or equipment can no longer be met by priorities. Fair and equitable distribution of available materials must be made between customers, old and new, and between consumers near at hand and those at more distant points.

It appears that if the industry handles itself well, and avoids inequities which would bring about demands for more restrictive legislation, the day of direct governmental control in the fertilizer industry will be gone from now on.

IF ever the research facilities in the field of agricultural chemicals were overtaxed, they are overtaxed today. Never in the history of American agriculture were more new chemical compounds clamoring for attention. In the field of agricultural fungicides and insecticides alone, over 5,000 new chemical products per year are being tried out to see if they have some application in plant disease, animal husbandry, or weed or insect control. The fact that ninety-five per cent of them never get to first base along the path toward practical use does not reduce the work of testing and screening.

That entomologists, plant pathologists and agricultural chemists the country over are "up to their ears" in testing new compounds naturally slows down the entire screening process. No sooner are research facilities expanded by government agencies and industry, than they again become overloaded with work. No matter how rapid the expansion in facilities, the increase in new compounds and projects appears to be more rapid. All of this augurs well for the future of new things chemical for agriculture, even though testing facilities for the time being may be overwhelmed. But it also calls for patience and understanding by industry and agriculture.

Guest Editorial written especially for this issue of Agricultural Chemicals.

Record agricultural production results from use of chemicals

By O. V. Wells

Chief, Bureau of Agricultural Economics
U. S. Department of Agriculture

AMERICAN agriculture increased production by one-third during World War II. It was this increase which allowed our civilian diets not only to be maintained, but even improved; allowed our soldiers and sailors to be the best fed fighting men in the world, and made possible enormous shipments of food for lend-lease and, more recently, foreign relief.

Such an increase would have been impossible without the help of the agricultural chemical industry. More and better insecticides and fungicides and almost a doubling in the use of fertilizers, helped offset growing shortages as the war progressed.

But now that the fighting is over, to what future can agriculture look? Can future markets be found or maintained for all that American agriculture, using fertilizer, insect controls and modern equipment, can efficiently turn out? How long will the American public continue to consume agricultural products at the current record level? The answer has a direct and important meaning to the entire chemical industry serving this field.

These are questions which agriculture and its representatives are actively discussing. But they are also questions in which all of us, whether consumers, farmers, or suppliers of agricultural chemicals, have an equal stake. Agricultural policy is no longer the concern of farmers alone. After all they not only produce the great bulk of our foods and fibers; they also constitute one of the key segments of the great American markets and in the case of many industries they are the chief market.

Simply stated, this all adds up to the fact that the interest of agriculture and of industry run in the same direction—that the businessmen who serve agriculture also need to look ahead to its further progress, to understand its basic objectives and the programs which it supports.

Farmers and businessmen can perhaps agree that the basic objectives of a successful agricultural policy should include:

(1) *Full and efficient production*: American agriculture

(*Turn to Page 64*)

AIF Association in Spring Meeting

THE Spring meeting of the Agricultural Insecticide and Fungicide Association was scheduled to open April 23, at the Westchester Biltmore Hotel, Rye, N. Y., with sessions continuing through April 24 and 25. Representatives of various branches of industry engaged in the manufacture and distribution of chemicals for Agriculture; speakers from the United States Department of Agriculture, and of the agricultural press were to appear on the program, as well as experts in finance legislation, and in the field of equipment for application of agricultural chemicals.

The first day, Wednesday, was set aside for meetings of various Association committees. Beginning in the morning, the Legislative Committee convened under the chairmanship of W. W. Sunderland, of Dow Chemical Co., with the Technical Committee meeting under the direction of Dr. L. Gordon Utter of Phelps-Dodge Corp., New York. The Association's board of directors met in an afternoon session. A dinner meeting was scheduled for the Membership and Information Committee, under the chairmanship of R. B. Stoddard of Dodge & Olcott, Inc., New York.

Open sessions began with registration Thursday morning, and the meeting was called to order by President George F. Leonard of

Editor's Note: New subscribers to AGRICULTURAL CHEMICALS *may not be thoroughly acquainted with the Agricultural Insecticide and Fungicide Association whose spring semi-annual meeting is reported in this issue. In order to provide a proper background, a brief history of the Association is presented.*

THE AIF Association was formed nearly fourteen years ago to coordinate the industry's efforts for better agricultural pest control. Today's pressing problems of legislation, standards and policies were already becoming evident; a trade association was the means whereby the industry members could pool their knowledge and experience, their ideas and viewpoints, toward solving such problems.

Many of the original officers and directors are still active in the Association. Ralph M. Chipman, then of Chipman Chemical Co. but now of General Chemical Co., was first chairman of the AIF board of directors. Others on the first board included the late R. Earl Demmon of Stauffer Chemical Co., George F. Leonard of Tobacco By-Products and Chemical Corp., George R. Rinke of John Powell and Company, J. Hallam Boyd of Commercial Chemical Co., R. K. Vickery of California Spray Chemical Co., Joseph B. Cary of Niagara Sprayer and Chemical Co., D. E. Connolly of Ansbacher-Siegle Corp., Howard P. Mansfield of Grasselli Chemical Co., George E. Riches of Bowker Chemical Co. and Arthur W. Steudel of The Sherwin-Williams Co.

Lea S. Hitchner, now executive secretary and treasurer of the AIF, was its first president, followed by Warren S. Moyer of Chipman Chemical Co.; then by Mr. Cary, and now by Mr. Leonard of Tobacco By-Products and Chemical Corp. Miss June Heitzman was the first secretary. R. K. Vickery was first vice-president; with the increasing representation from the West Coast he has been followed by Harold C. Davies of California Spray-Chemical Corp.

The Association first met in 1934 in Haddon Hall at Atlantic City, with 14 member companies. Steady growth since then has raised the membership close to 80 companies, representing more than 85 percent of the total United States tonnage of agricultural insecticides and fungicides, and AIF influence is recognized as an important factor in its field.

Association offices since the beginning have been at 285 Madison Avenue in New York.

S. A. ROHWER

Sievert A. Rohwer is a native of Colorado. He joined the U. S. Department of Agriculture as an entomologist in 1909, and has been an assistant chief of that Department's Bureau of Entomology and Plant Quarantine since it was created in 1935. He has been on the editorial boards of both national entomological societies, president of the Entomological and Biological Societies of Washington, and vice-president of Washington Academy.

DR. WILLIAM J. HALE

Dr. William J. Hale was born in Ohio, earned his first degrees at Miami, O., and went on to Harvard, Berlin and Gottingen; taught chemistry at Michigan University from 1904 to 1919; and in 1919 joined Dow Chemical Company as director of organic chemical research. He has been a division chairman in the National Research Council, visiting professor at Connecticut, member of British, French and German chemical societies, and active in farm chemurgy.

DR. W. G. REED

Dr. W. G. Reed, head of Federal Insecticide Act enforcement, began his career as a veterinary physician. Entering the USDA in 1929, he made an outstanding record in technical and administrative posts in the meat inspection service. For the past two years he has been chief of the Insecticide Division, Livestock and Meats Branch, Office of Marketing Services, of the U. S. Department of Agriculture.

Tobacco By-Products & Chemical Corp., Louisville, Ky. Lea S. Hitchner, executive secretary and treasurer of the Association gave his report to the group, reviewing the activities of the Association since the annual meeting last September.

He told of steps now being taken toward dealer education, and of the appointment of a committee to work out details. Members of the committee include Dr. George C. Decker of the University of Illinois; Dr. Charles E. Palm of Cornell (representing the American Association of Economic Entomologists), Dr. J. G. Leach of the University of West Virginia, and Dr. J. G. Horsfall of Connecticut (representing the American Phytopathological Society). Association representatives include W. W. Moreland of Rutgers University; M. L. Somerville, Sherwin-Williams Co.; Dr. C. L. Smith and Mr. Hitchner of the Association staff.

The Association is also cooperating with the American Chemical Society, American Phytopathological Society and Federal bureaus to recommend generic names for the new organic materials, Mr. Hitchner reported.

A need for the dissemination of fundamental information on insecticide and fungicide regulatory laws was pointed out by the secretary. He indicated that it is possible after long research and testing, for a product to be placed on the market, and for some law to prevent its sale except to certain sales outlets. Special labeling may be required, or in many other ways the product may be restricted in its distribution. The model State Law as drafted by the Council of State Governments was cited as a logical solution for many of these conflicting regulations. Further cooperation of the association with government agencies in the furtherance of the industry was pledged.

Dr. William J. Hale, research consultant of the Dow Chemical Co., Midland, Michigan, and a leader in the farm chemurgic movement, addressed the meeting on the subject "Progress or Peonage on the Farm," pointing out how necessary it is that forward steps toward scientific advancement be continued in agriculture.

A view into the economic situation was presented by Walter Mitchell, Jr., vice-president of the Irving Trust Company, New York. Mr. Mitchell addressed the group on "Trade Associations in the Present Economy." He drew upon the broad experience of past years in which he was engaged in many phases of business and public relations, to bring his listeners up to date on the responsibilities of trade groups in maintaining economic equilibrium.

The first general report of the Traffic Committee was given by E. C. McClintic, chairman. The railroad situation was reviewed, and an over-all picture presented of the problems facing the industry in the matter of transportation.

Application Equipment

A comprehensive address on "Application Equipment for Sprays, Dusts, and other materials" was given by Frank Irons, Associate Agricultural Engineer, U. S. Department of Agriculture, Toledo, Ohio. Mr. Irons went into detail to describe some of the latest methods of

LEA S. HITCHNER

Lea S. Hitchner, a native of New Jersey, has been in the agricultural insecticide and fungicide field for more than 30 years. He prepared for his career at Banks Business College, and the Wharton School of Finance and Commerce at the U. of Pennsylvania. He helped organized the Kil-Tone Co. of Newark, N. J., and subsequently became president of the firm. He was the first president of the A.I.F.A. He has been Executive Secretary-Treasurer of the Association since 1940.

WALTER MITCHELL, JR.

Walter Mitchell, Jr., was born in New Haven, Conn., and was graduated in 1925 from Sheffield Scientific School of Yale University. Since then he has handled advertising and public relations in the automotive field, served as distribution economist at Allied Force Headquarters in North Africa, served in U. S. Department of Commerce and the NRA, held executive posts in Dun & Bradstreet, Inc., and now is a vice-president of Irving Trust Co., New York.

B. KIRK FOX

Buell Kirk Fox was born on an Iowa farm, studied at Iowa State College, was an Air Service Lieutenant in World War I, and became associate editor of "Dairy Farmer" (Waterloo, Ia.) in 1920. In 1922 he joined "Successful Farming" (Des Moines, Ia.) and since 1928 has been its editor. He is active in the affairs of organizations such as the U. S. Chamber of Commerce, National Safety Council, National Victory Garden Committee, Des Moines Chamber of Commerce and four fraternities.

applying various types of insecticides, fungicides and weed killers. His talk indicated that a number of new principles are being employed in certain machines soon to be seen in the field. New developments in the chemical field must be matched by mechanical developments in application equipment to insure that these new toxic materials are applied efficiently, he stated.

To illustrate his talk further, Mr. Irons showed at the afternoon session moving pictures of many of the machines mentioned in his morning address. Pictured in action were numerous devices for spraying and dusting, with various shots revealing the ability of the equipment to cover large areas, to reach to the tops of tall trees, etc. Certain models were made specially for particular jobs, while others were described as being adaptable for a number of types of work.

The afternoon business session consisted of an informal open discussion by members of the Association Counsel and staff. It was a question-and-answer meeting in which all Association members were invited to take part.

George P. Lamb, attorney of Washington, D. C., a specialist in trade law, was the main speaker at the dinner Thursday evening.

Friday morning's session was again called to order by president Leonard who called upon Dr. L. Gordon Utter to present the report of the Technical Committee of which Dr. Utter is chairman. He told of the multiplicity of problems which had come to the attention of the committee during the past year, and gave their recommendations for procedure for the coming year.

A similar report was presented by W. W. Sunderland, chairman of the Legislative Committee. Mr. Sunderland introduced to the group a number of legislative guests attending the meeting.

Chairman R. B. Stoddard of the Membership and Information Committee next reported the activities of his group, relating first the work done on the information program, and later presenting recommendations for certain changes in Association regulations regarding membership.

The first guest speaker of the second day was Orvis V. Wells, chief of the Bureau of Agricultural Economics of the U. S. Department of Agriculture, Washington. His subject, "Agricultural Prices" covered a wide range of economic factors which influence farm prices and have a direct effect on the sales potential of the insecticide, fungicide, and weed killer industries.

Mr. Wells is widely known as an authority on agricultural planning, the analysis of agricultural prices, farm management, and the employment of statistical methods in agricultural research.

Representing farm journalism in general and *Successful Farming* in particular, Kirk Fox, editor of that magazine, discussed the subject, "Should the Scientist Emulate the Sphinx?" His talk, final prepared address of the meeting, preceded a round-table discussion on the "Use, Toxicity and Nomenclature of some recently discovered Agricultural Chemicals."

GEORGE F. LEONARD
Tobacco By-Products & Chemical Corp.
President of A.I.F.A.

HAROLD C. DAVIES
California Spray Chemical Co.
Vice-president of A.I.F.A.

This discussion was led by a panel including S. A. Rohwer, assistant chief, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture; Dr. F. P. Cullinan, assistant chief, Bureau of Plant Industry, Soils and Agricultural Engineering, U.S.D.A.; Dr. A. J. Lehman, chief of the Division of Pharmacology of the Food and Drug Administration, and Dr. W. G. Reed, chief of the Insecticide Division, Production and Marketing Administration, U. S. D.A.

The desirability of simplifying the nomenclature of products having confusingly similar names was discussed by the group, with comment and questions invited from the floor. Such names as "Chlordane" and "Piperonyl Butoxide" were mentioned. These names were recently accorded Federal acceptance and full information on terminology and toxic properties has been supplied to State enforcement officials to assure universal understanding of these two new materials. Familiarity of the industry and the consumer group with these new simplified names would make unnecessary the inclusion of long formulae in advertising and labeling, and would help to minimize confusion. A review was made of the decision to adopt the name "benzene hexachloride" rather than "hexachlorocyclohexane" for the toxic material $C_6H_6Cl_6$. It was pointed out, however, that while the Bureau of Entomology and Plant Quarantine favors use of "benzene hexachloride" in designating the material, no objection would be raised, for the present, to the use of either name provided the percentage of gamma isomer is indicated on the label.

The final afternoon of the convention comprised a meeting of the Industry-Government Committee on Application Equipment, during which time ideas were exchanged on new methods of applying various toxic materials. A review of previous discussions on the subject indicated the need of close cooperation between manufacturers of such equipment and the Governmental agencies which help develop new materials for insect and plant disease control. Chairman of this meeting was Jack Vernon of Niagara Sprayer and Chemical Division of Food Machinery Corporation.

On the lighter side, a golf tournament was scheduled for part of Thursday afternoon, and a stag dinner was to be held Thursday evening. Committee in charge of the golf tournament was composed of Henry Wood, of Tobacco By-Products & Chemical Corp., chairman; William F. Hall, Chipman Chemical Co., and Harold Beckman of California Spray-Chemical Corp.

The meeting attracted one of the largest registrations recorded for any spring meeting of the Associa-

Westchester Biltmore Hotel, Rye, N. Y., scene of A.I.F.A. spring meeting.

tion. This gathering was restricted to members of the association, but the fall convention scheduled for early in September at Spring Lake, N. J., will be open to all persons interested in the industry.

Entomologists Meet in Iowa

The Second Annual Conference of the North Central States Branch of the American Association of Economic Entomologists was held at Hotel Ft. Des Moines, Des Moines, Ia., March 27 and 28. In conjunction with the conference were meetings of the National Plant Board, North Central States Apiarists' group, and the annual Codling Moth Conference.

Appearing on the program was Dr. G. Fraenkel of the Imperial College of Science and Technology of London, England, and Dr. B. P. Uvarov, Director, Anti-Locust Research, also of London. Other speakers included entomologists of American agricultural experiment stations and the U.S.D.A. Open discussions featured the meeting, with emphasis on a study of insecticides and insects affecting various crops.

Co-op Spray Service

Southern States Cooperative, Richmond, Va., has announced the inauguration this spring of a new spraying service for control of flies and other insects in dairy barns of the organization's members. At the start the service will be limited to certain communities, but will be expanded as demand warrants, it was stated. A 5 percent DDT solution will be used with special spraying equipment controlled by skilled operators. The service will be offered on a cost basis.

"Orseco" Brand Announced

Organic Chemicals Corp., Frederick, Md., has placed on the market a new line of DDT insecticides. The brand name is "Orseco." The firm also announces that it has expanded its Aero-Spray division and is making experiments in the application of fungicides and other agricultural chemicals not formerly applied by airplane.

California Fertilizer Association Meets

THE California Fertilizer Association held its spring meeting at Hotel Clark, Los Angeles, March 14. Ten papers were presented to the group during the course of the day, and representatives of the industry from all parts of the state were in attendance.

Keynote address of the meeting was given by Dr. Oliver E. Overseth,* executive secretary and manager of the association. He outlined the responsibilities of the industry to the farmer.

Other papers included discussions pertaining to association activities, and the supply situation as regards potash, superphosphate, and sulfate of ammonia. These papers were prepared for presentation by Dr. George F. McLeod, Sidney Herzberg, M. M. Stockman, Grover C. Dunford, Dr. Ray E. Neidig, David B. Scott, George P. Bloxham, Earl J. Willis and Weller Noble, all prominent in California fertilizer circles.

Mr. Stockman, sales manager of the Mountain Copper Co., San Francisco, reminded the group that although for the past few years the industry has been enjoying a sellers' market, the time may soon come when competition will again become strong. He stressed the importance of association unity which "can instill confidence among the members to a degree where this change can be made in an orderly fashion." He stated further that group discussions bring to light many facts which often help to prevent the spread of unfounded rumors in the industry. He urged the holding of more frequent meetings at convenient locations so that more fertilizer representatives may attend.

Mr. Stockman expressed the need for a central agency to publish factual information so that farmers may know the actual distribution of cost of a given fertilizer. He told of reading a 1946 bulletin issued by a county agent who was presenting the relative cost per pound of nitrogen in various forms of fertilizers. "The bulletin started out," he says, "with ammonium sulphate at 12.4 per pound; ammonium nitrate at 12½c per pound, and it continues down through the various forms of straight nitrogen fertilizers, mixed fertilizers and liquid fertilizers to a final figure of $8.00 per pound for the nitrogen contained in a certain liquid fertilizer. In all cases they have allotted the total cost of the material to nitrogen. In between these extremes is listed a 10-10-5 mixed fertilizer to which they attach a cost of 30½c per pound for nitrogen. This figure is based on a sale price of $61.00 per ton.

"Regardless of what opinion this agent holds as to the value of phosphate and potash, these materials do have a definite cost and experience shows they have a beneficial effect; otherwise there would be no demand for them . . .

"To attribute the entire cost of a mixed fertilizer to nitrogen is false information from any viewpoint . . . A farmer . . . would immediately assume the fertilizer manufacturer was making 2½ times as much money selling nitrogen in 10-10-5 as he does in a straight nitrogen . . . . The potash and phosphate included in mixed fertilizers have a definite cost . . . a check of the cost of nitrogen in 10-10-5, made with all ammonium nitrogen, shows the nitrogen does not cost in excess of 15c a pound."

Dr. George F. McLeod, technical director of Sunland Industries, Inc., Fresno, told the group that the industry will benefit from individual thought and effort on the part of its association members. "There is no problem—prices, labor, governmental competition, professional ethics, or any other you can name, which will not yield to unselfish, informed and aggressive thinking and action" by men of the industry, he said. He indicated that associations are valuable, pointing out that the industry needs the force of sound, progressive and intelligent collective thinking as well as the same qualities in individuals.

* Excerpts from Dr. Overseth's talk are published elsewhere in this issue.

Profitable Market Seen In Expanding Sales of WEED KILLERS

ALTHOUGH many persons at first wondered if 2,4-D weed killer could survive the pressure of vigorous examination and the test of time, it now appears that weed killers based on 2,4-dichlorophenoxyacetic acid are definitely here to stay. Acceptance by both scientific investigators and the public has made the material a major factor in considerations involving control of weed pests in agriculture. A definite field exists for the use of 2,4-D in scores of applications ranging from control of dandelion in countless lawns, to large-scale operations on thousands of square miles of land where weeds make the ground unproductive for commercial crops.

Along with the development of the material, however, must come efficient application equipment to make possible proper distribution of the liquid; and thorough education for users in order to gain the best results. Without sufficient knowledge of proper methods, users of 2,4-D are likely to meet with disappointment.

The purpose of this article, therefore, is to provide basic information regarding 2,4-D weed killers, so that users may avoid some of the hazards involved. Just as many grasped the opportunity to apply DDT preparations to livestock and animal shelters along with its many other uses, so can custom sprayers and others interested prepare to offer a similar service in controlling weeds with 2,4-D.

As has been pointed out previously (1), the development of 2,4-D as a selective weed control agent has aroused great interest and activity in the destruction of undesirable vegetation. Never before has it been possible to destroy certain lawn and agricultural weeds without seriously damaging or destroying grasses or crops. With the public interest stimulated by recent nation-wide publicity regarding this new agent and public attention focused on weed destruction, a rare opportunity is offered those who decide to enter the weed control service field. City dwellers and farmers alike are acquainted with the usefulness of 2,4-D.

Last season we witnessed considerable demand for weed control in lawns by homeowners, apartment operators and institutions. Greenkeepers experimented with this new agent on golf course fairways. Activity in the agricultural field was slight because of the need for more extensive experimentation. This year, with the sanction of many weed control groups, we should witness extensive application of 2,4-D in agriculture. An individual entering the weed control service field need not fear that he is entering a "fly by night" activity. Although certain weed killers of the 2,4-D type may accomplish sensational results after one application, additional treatment may be needed the following season. Just as insects and rodents often reinfest property where adequate control measures have been taken, so can weed seeds blow from adjoining untreated areas to reseed lawns or fields in which these pests were once controlled. Thus repeat business may be expected from satisfied customers.

Properties and Forms of 2,4-D

The active constituent of 2,4-D weed killer is a white, crystalline, water-insoluble solid of characteristic odor. Its chemical name is "2,4-Dichlorophenoxyacetic acid." In its pure chemical form this compound is not suited for use in weed control operations. It must first be combined with other materials and processed so that it can be diluted before application. The principal classes of 2,4-D preparations employed for weed control are as follows:

(1) Water soluble salts of sodium, ammonia or organic amines.
(2) Solutions of 2,4-D in agents which emulsify readily in water.
(3) Esters of 2,4-D
(4) Dusts consisting of one of the above compounds in a pulverized, dry, inert carrier.

The products of the first class are available as powders which are fairly soluble in water, or liquid concentrates which can be mixed with water in all proportions. Those of the second class usually are available as clear solutions which form creamy emulsions when mixed with water. The esters, belonging to the third class, are usually offered to the trade in the form of emulsions or as clear liquids which emulsify in water.

Most investigators agree that satisfactory results can be obtained by the use of preparations from any one of the first three classes, provided the solutions applied are of the same 2,4-D strength and that they completely wet the foliage sprayed. Slightly better control of woody growth such as poison ivy, chokecherry, and sprouts of various kinds is believed to be possible with esters of 2,4-D. On the other hand esters are more damaging to cereals or other farm crops than the sodium or amine salts.

Dusts of class four are recent additions to the weed killing group. Successful applications have been made with hand dusters, power equipment and by airplanes. By using 2,4-D dusts, the weight of herbicide transported is maintained at a minimum. However the danger of drifting onto desirable vegetation is in-

By

L. S. De Atley

Thompson-Hayward Chemical Co.
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creased. Airplane dusting is well suited for the control of weeds in sugarcane and rice fields.

In the selection of a 2,4-D weed killer, careful consideration must be given to the actual 2,4-D content of the product. It may be more economical to purchase a product offered at twice the price of another if the former contains more than twice the other's 2,4-D content. The actual 2,4-D strength must not be confused with the percentage of 2,4-D compound present. For example, a product labeled as containing 90% of 2,4-D sodium salt may contain only 76% actual 2,4-D. Similarly one containing 14% of butyl ester contains only 11% of 2,4-D. It is the 2,4-D acid that is important, so the purchaser must insist upon being advised of the extent to which it is present. Normally 2,4-D liquids contain from 5 to 40% of actual 2,4-D. Generally powders contain 10% to 85% of 2,4-D. Usually the liquids are much easier to dissolve in water and are of about the same cost as powders per unit of 2,4-D present.

Action of 2,4-D

Assuming that the operator has selected a reliable 2,4-D weed killer he now wishes to know the action of this material so that he may interpret the results obtained and explain them to his clients. The performance of this weed killer is affected to some extent by factors such as the strength of solution used, type of weed sprayed, quantity of weed killer applied, rate of growth of the plant, atmospheric temperature and moisture in the soil.

In general, the action of weeds after 2,4-D treatment is characteristic and is well described by the following statement issued by one of the Experiment Stations 2), "In warm weather, the reaction of weeds to 2,4-D usually can be seen within 24 hours. Weeds are not killed in that period, nor are they discolored or 'burned,' but the stems and foliage curl and after a few days tissues usually become crisp and crack easily when bent. Later there may be some slight yellowing or other color changes. Death comes in from three weeks to a month or more."

Of course there are some few weeds which do not undergo these destructive changes following 2,4-D application, and fortunately our common lawn grasses are not noticeably affected. This selective action of 2,4-D compounds, which permits them to destroy weeds without serious damage to common grasses, to cereal crops and to other agricultural crops when properly applied, has resulted in wide acceptance and has placed them in a favorable position. Weed killers have been available for many years, but none possessed the selective action of 2,4-D.

Many Weeds Controlled

INVESTIGATORS have compiled lists (3), (15), of weeds controlled by 2,4-D when applied at various concentrations. These lists include an impressive number of weeds which are common to lawns, golf courses, pastures, cereal fields and farm crops. Only a few of the common turf pests are not controlled. Among those readily controlled are dandelion, plantain, chick weed, ragweed, ground ivy, morning glory and pepper grass. Outstanding results have been reported in the control of dandelion and narrow-leafed plantain. By proper appplication of a 2,4-D compound, 98% of the dandelions were eliminated from a test plot over a period of a year and a half. Further, a Kentucky blue grass plot which had been treated with a 2,4-D preparation in August, 1944, remained completely free of narrow-leafed plantain in May, 1946, although this pest was thriving before treatment (4).

Unfortunately, bent grasses, which at times are found in lawns but more generally are found in golf greens, may be seriously damaged by 2,4-D applications. It has recently been announced that bent grass which is about 1½ inches tall is much more resistant to 2,4-D treatment than that which has been closely clipped. Also white clover is susceptible, but by proper timing of treatment, its complete destruction may be avoided (5). If the lawn is treated early in the season, white clover may recover and reseed. Also if 2,4-D application is withheld until late in the season the seed may have matured sufficiently to guarantee reseeding.

Although much time has been devoted to experiments related to the control of agricultural weeds, more extensive investigation is still required. Last seasons results were very encouraging and have led to more general recommendations for the use of 2,4-D in agriculture. Although some farm weeds appear to be completely destroyed by 2,4-D application, others even though growth is appreciably reduced, persist after several treatments. Among the weeds which will be controlled this season with 2,4-D are beggar ticks, black medic, dog fennel, false flax, giant ragweed, pig weed, shepherd's purse, wild mustard, Canada thistle, sow thistle, horse nettle, gum weed, hedge bindweed, lamb's quarters, pokeweed, sheep's sorrel and many others. Woody plants such as alder, barberry, buckhorn, chokecherry, dogwood, elderberry, hawthorne, mesquite, sumac, sassafras, and willow, which often occur along fence rows, creek banks, or road sides, may be controlled effectively by proper 2,4-D applications. Seed formation of perennial weeds such as Canada thistle, morning glory, blue lettuce, and sow thistle, and a number of similar types of undesirable vegetation can be prevented by spraying with 2,4-D preparations before seeds have developed.

In the South, 2,4-D has been quite effective in controlling the alligator weed, (14) which is particularly

damaging to sugar cane, rice and truck crops. Also indigo, Mexican weed and curly indigo are susceptible to 2,4-D treatments. In treating many fields, airplane application has been found feasible and economical.

Bindweed is one of the most serious agricultural weed pests. Accordingly it has received considerable attention in 2,4-D investigations. Results in some sections of the United States and Canada have been successful; however in other cases some regrowth was found after 3 or 4 applications. In some instances (6) 95 to 100% eradication has been reported. In general it has been concluded that repeated application is required for bindweed control and that application should be made to prevent seed formation.

The control of poison ivy, poison oak and poison sumac by 2,4-D has been a matter of controversy among investigators. There is no question as to the ability of this weed control agent to destroy the exposed portions of these plants, but regrowth has been reported in a number of cases. Repeated applications, whenever new growth appears, may eventually effect complete control.

As previously indicated, the action of 2,4-D is most noticeable on broad-leaved plants, and grasses seldom are affected. Thus it is not surprising that Bermuda grass, crab grass, Johnson grass, foxtail and some other undesirable grasses are not destroyed by 2,4-D. Certain other steps may be taken in severe cases to eliminate this type of vegetation. After the elimination of broad-leaved plants, seeding and fertilizing often encourage the growth of desirable plants so that they crowd out these less desirable grasses.

Preparation of Solutions

AS the strengths of commercial 2,4-D preparations vary considerably, it is best to follow the instructions of the manufacturer in making dilutions. For normal use, a solution containing 1 part of actual 2,4-D acid in 1000 parts of water (equivalent to 1000 parts per million) is recommended. If this is to be prepared from a liquid containing 40% 2,4-D acid (not 40% of a 2,4-D compound) 1 pint of the concentrate should be mixed with 60 gallons of water. On the other hand if a powder containing 70% 2,4-D acid is to be used, 10 ounces is sufficient to produce 50 gallons of spray. The liquids usually mix readily with water, whereas several minutes stirring normally is required to dissolve the powders completely. Because of possible chemical reaction between the weed killer and other substances, equipment used for mixing and for spraying should be free of foreign materials.

Application of Weed Killer

ANY spray equipment capable of producing a uniform application of the diluted 2,4-D solution may be employed. A medium spray is satisfactory, and high pressure is not required. The minimum equipment required for a commercial operator engaged in lawn weed control is a 2½ to 3 gallon knapsack pressure sprayer. Larger equipment may be more desirable for extensive lawn work and of course is essential for weed control on golf courses, pastures and fields. It is essential that the equipment be so constructed that it may be moved easily from one point to another. Usually mobile equipment is employed where application is made over a large area. Many of the larger mobile motorized units are elaborately equipped and will spray many acres in a single day. Frequently a path 20 or 30 feet wide can be sprayed as the unit moves down a golf fairway or across a pasture.

In most cases of lawn treatment, the entire area should be given a uniform spray application. Normally 1 gallon of diluted spray is sufficient to cover 200 square feet of lawn except in cases of exceptionally heavy weed growth. Here increased application is needed to cover the greater weed surfaces. In some instances weed growth in lawns may be concentrated in isolated areas. In others it may be desired to protect white clover in certain portions of the lawn which are weed-free. In such cases treatment of only portions of the lawn may be justified, although this normally requires as much time as complete coverage.

In agricultural applications pastures may be given complete treatment if legumes are not an important part of the growth. In other cases where extensive legume growth is present and weeds exist only in limited areas, spot application is recommended. In heavily infested fields of cereal grasses, application should be made before the jointing stage or after the crop has reached the milk stage. Some stunting of growth may result from the application of 2,4-D compounds to a weed-free field of a cereal crop, but when weeds are a serious problem the greater freedom given the crop by weed destruction permits it actually to show increased production. For treatment of corn, application should not be made until the corn has reached the milk stage. Normally in the treatment of weeds in field crops, the 2,4-D sodium salt or amine compounds are recommended over the esters.

In the treatment of woody growths such as saplings or bushes

which are prevalent in rocky areas, along fence rows, in road side ditches or along creek banks, thorough, heavy application is essential. The foliage must be well wetted. The esters of 2,4-D or 2,4-D compounds in combination with kerosene have provided quicker and more thorough control on growth of this type than the other 2,4-D compounds.

Application should be made when the soil is moist and the weeds are in an active growing state. It is essential that the weed plant absorb the herbicide and transport it to its very root tips. This cannot be accomplished during the hot summer weather when the ground is dry and weeds have reached a dormant stage of growth. Temperature, too, is important, and positive results are more noticeable if the reading is 70°F. or above. Recently it has been determined that temperatures of 40 to 60° F. do not prevent the action of 2,4-D but reduce the speed of its performance. The final results several months following treatment appear to be the same as obtained at higher temperatures. Some investigators indicate that temperatures in excess of 90°F. may cause damage (5). Rainfall immediately following 2,4-D apppli-cation may prevent its action. Normally, if 6 hours or more have elapsed after weeds have been sprayed, rainfall will not lessen control appreciably (8), (5), (9).

The importance of applying 2,4-D weed killers on a still day cannot be over-emphasized. Careless operators have destroyed ornamentals, portions of vegetable gardens and portions of field crops by permitting spray mists to drift away from the area being treated. Roses, honeysuckle, tomatoes, and many forms of desirable vegetation are just as susceptible to the action of 2,4-D as are weeds (10), (11).

Precautions in Application

ONE of the great advantages in calling upon a specialist to apply 2,4-D rather than relying on one's own ability, is that he is better trained in the safe handling of hazardous materials. So, in weed control the commercial operator must be acquained with the potential hazards

of the control material and must use this knowledge and his skill in protecting his client. Thus a thorough study of the dangers of 2,4-D is as essential as are details regarding its use.

As already emphasized, drifting of 2,4-D spray onto desirable vegetation must not be permitted. The sad experience of the California vineyardist (8) who destroyed his entire 35 year old Tokay Vineyard worth thousands of dollars in an attempt to eliminate the growth of dogbane need not be repeated if care is exercised. Application of spray should be limited to weeds, and heavy applications to the soil through direct spraying or excessive "run off" from the treated weeds must be avoided. Especially in dry periods enough 2,4-D may be retained to hinder the growth of desirable vegetation through its action upon the plant roots (5). Usually if normal rainfall has intervened after spraying at summer temperatures, less susceptible crops may be planted a month after soil has actually been treated with 2,4-D, but a period of two months is recommended for less resistant plants. (15)

Spray equipment used for the application of 2,4-D preparations should be reserved for this purpose exclusively if at all possible. Removal of 2,4-D residue from spray equipment is extremely difficult, and if the same equipment is employed to apply agricultural or horticultural insecticides, very thorough cleaning is necessary. Even minute quantities of 2,4-D remaining in spray equipment may be sufficient to damage or destroy flowers or vegetables sprayed later for insect control.

Best results in cleaning equipment which has been used for the application of 2,4-D preparations are obtained by using a warm alkali solution. This may be prepared by dissolving one ounce of household ammonia, trisodium phosphate, sodium metasilicate or sal soda per gallon of warm water. The spray equipment should be filled with this solution and the contents agitated to be certain that no portion of the interior remains untouched. After standing about an hour, approximately 1/3 of the contents of the spray tank should be discharged through the hose and spray nozzles to remove any residue from this portion of the equipment. The remainder of the cleaning compound can then be discharged and the equipment rinsed out two or three times with warm water.

Lawn treatment with 2,4-D should not be practiced immediately before seeding or thereafter until new grass has reached a height of about one inch (2). Application at seeding time may reduce germination and result in an inferior stand of grass (12), (13).

Extremely weedy lawns may be left with numerous bare patches after 2,4-D treatment. Unless steps are taken promptly to sow grass seed and stimulate grass growth by fertilizer applications, weed-like grasses may soon occupy the areas formerly covered with weeds. Weed destruction is the first-step, but this must be followed by seeding, fertilization and proper lawn maintenance if a healthy, abundant stand of grass is to be attained.

(*Turn to Page 67*)

hydrocyanic acid gas

FUMIGATION

DURING the past fifty years, the use of hydrocyanic acid gas for control of scale insect pests of citrus trees has become standard practice. Its discovery is rated among the most important in the field of insect control, and the gas remains the standard material for control of citrus pests. The process of applying the gas consists of covering the trees with cloth tents, and then liberating a measured quantity of the material beneath the tents. The insects are killed by exposure to the toxic gas, there being little, if any possibility of escape.

Pulling the fumigation tents over the trees is accomplished by special mobile equipment by which the covering is put in place quickly. Once in place, the dosage of gas to be used is computed by means of carefully formulated charts which indicate the correct amounts of gas for the number of cubic feet in a given tent. Computation of this latter figure is easily made from markings on the tent indicating vertical height, and by use of similar markings on the horizontal sides of the tent.

The measured quantity of hydrocyanic acid as indicated by the dosage determination is applied under the tent. This may be in the form of liquid hydrocyanic acid, or "Cyanogas,"* either of which may be used under certain conditions. There is a considerable variation in the dosage of hydrocyanic acid gas necessary to kill the widely-different species of scale insects encountered.

The fumigant, hydrocyanic acid, is available in two forms, liquid HCN and "Cyanogas." The choice of one of these most suitable for use at any time will depend upon a number of factors.

Liquid HCN

Liquid hydrocyanic acid, commonly designated as HCN, is used widely for the fumigation of citrus trees in California. This liquid is manufactured at Azusa and is shipped in steel drums by auto truck to the points where it is used. This is possible since the citrus districts are well concentrated, and all within comparatively short distances from the manufacturing plant. Also, the temperatures prevailing in these citrus areas are moderate and no special difficulties are encountered in handling the liquid.

Special devices for measuring and applying the liquid HCN are provided by the HCN manufacturers. These devices, or applicators, are of two types. One type atomizes the liquid through small nozzles, permitting rapid evaporation and diffusion of the gas within the space under fumigation. The other device vaporizes the liquid so that it emerges from the discharge nozzle as a gas. The vaporizer is a rather complicated machine involving a fuel tank and boiler designed to generate and store heat enough to vaporize the HCN as it is used, and the pump or measuring device for controlling the dosages.

These applicators may be adjusted to apply any desired quantity of hydrocyanic acid proportional to the size of the trees. As an illustration, the normal dosage is 18 cubic centimeters of liquid HCN per unit of tree size as shown in the dosage

* Manufactured by American Cyanamid Co., New York.

Citrus trees are completely covered by tent, and sealed with dirt at bottom to prevent seepage. Opening at front is called the "dog hole," used to let out air before fumigation, and serves as opening for delivery pipe. Markings on tent enable crew members to determine cubic contents.

By

H. J. Langhorst

American Cyanamid Co.
New York

Hydrocyanic acid used both as liquid and gas for control of citrus pests. Special handling necessary for storing and transporting, since liquid boils at 79° 7 and freezes to snowy solid at temperature of 10°

chart. An average sized tree would measure about 14 units. Then 14 times 18 cc of the HCN would be applied to this tree. If a lighter or heavier dosage seems desirable, then 16 cc or 20 cc per unit could be applied by making a small adjustment on the applicator. The liquid measurements are made accurately by direct displacement of a measured column of the liquid in a cylinder.

Application of the liquid is comparatively simple. Through the measuring device, regardless of whether the atomizer or vaporizer type of machine is being used, the desired quantity of the liquid is expelled. This issues through a discharge hose, or the atomizer nozzles, directly under the tent-covered tree where it diffuses rapidly to all portions of the enclosed space. The applicator nozzle is withdrawn from the tent and the same procedure repeated for each tree to be fumigated.

Liquid HCN must be kept cool. At the manufacturing plant, it is kept in cold storage rooms. When loaded on auto trucks for shipment, the drums are iced and covered with wet burlap in order to keep them cool. Each fumigator has his storage room prepared for keeping the drums cool. When the drums are taken to the orchards, they are kept cool by ice and wet sacks. It is highly important that the HCN be kept cool, well below its boiling point of 79° F. If it is not kept cool, pressure develops in the drums, making the HCN both difficult and dangerous to handle, with large losses from evaporation.

Liquid hydrocyanic acid as used commercially today, is a clear colorless liquid which boils at 79° F. and freezes to a snowy solid at 10° F. It is approximately seven-tenths the density of water. HCN votalilizes rapidly at all temperatures, forming a colorless vapor slightly lighter than air. Despite the fact that the vapor is only slightly lighter than air, it diffuses with the air rapidly and completely. The gas has a characteristic odor reminding one of bitter almonds, and extremely small amounts of gas can be detected in the air.

The period of time during which the fumigant is allowed to remain under the tent is uniformly 45 minutes. This is termed the "exposure." At the end of that time, the tents are pulled on to adjacent trees and the same procedure of measurement, dosage determination, gas application, and exposure is repeated.

Equipment and Materials

FUMIGATION tents are usually made from canvas or sheeting. Choice of material used is determined by the fumigant, by the atmospheric conditions prevailing where the tents are to be used, and by the types of trees and the varieties of insects. In Southern California, where many thousands of acres of citrus trees are fumigated each year, the tents in most common use are either 6½ ounce drill throughout, or made with 8 oz. U. S. Army Duck centers and side stripes of 6½ ounce drill.

Within the past four years, a considerable amount of work has been done using tents made from a lighter

The fumigation crew in action. Teamwork makes for speed and efficiency in the process. At left, operator is applying measured dosage of "Cyanogas" while crew foreman at next tent computes amount of toxic gas necessary to kill insects in that area. Other tents are also ready.

When a tree has been under fumigation for 45 minutes, the tent is removed by pulling it onto a tree in the next row. Here a crew prepares to shift tent to tree at right. Poles fit in tent rings to avoid slipping.

weight of cloth, such as 350 sheeting. For avocado trees, which are brittle and cannot withstand the weight of the heavy tents without considerable damage, these light tents are used almost exclusively. The light tents also have advantages in lower initial cost and greater ease of handling. Extensive studies of fabrics for fumigation tents have been made. These studies have included gas leakage through the various types of cloth, durability and wearing quality of the cloth in fumigation usage, and cost and availability of the fabrics. The tents are flat and octagonal in shape. In the construction and marking, allowance must be made for shrinkage. The size of a tent is indicated as the distance between any two parallel edges of the octagon. They are made to accommodate the various sized trees. The most common sized tents are 36, 40, 42, 45, and 48 feet, although some of the large old trees require considerably larger tents.

Properties of HCN

LIQUID HCN is inflammable and it burns with a lavender colored flame. The products of the combustion are harmless, being nitrogen, carbon dioxide, and water vapor. Hence, one of the simplest means for removing danger from HCN which has been spilled, or otherwise must be disposed of, is to set fire to it and let it burn.

Hydrocyanic acid vapor when mixed with air is inflammable and explosive. However, there must be at least 10 percent of the HCN vapor mixed with the air before it can be ignited. Concentrations of the gas which are reached even in the heaviest commercial fumigation are never near this figure. In citrus tree fumigation where 18 cc of liquid HCN per unit of tree size is the dosage, the maximum percentage of HCN is .4%.

Liquid HCN is stable when pure and may be kept for several months without deterioration. Aqueous solutions are less stable, and the larger the percentage of water present in the solution, the shorter will be its period of stability. The ordinary commercial liquid, 96-98% HCN, is slightly acid in reaction and is only slightly less stable than pure HCN. The liquid should always be kept cool and not stored for more than a few weeks at most.

Hydrocyanic acid, both the liquid and its vapor, has only a small corrosive effect upon most metals. In general, the metals are as much affected by water as by hydrocyanic acid. It is not corrosive to clothing nor harmful to the flesh. Both the liquid and its vapor are poisonous to all animal life and it is this property from which HCN derives its usefulness. It is not a germicide. It should be handled with the utmost caution.

Dust Fumigation

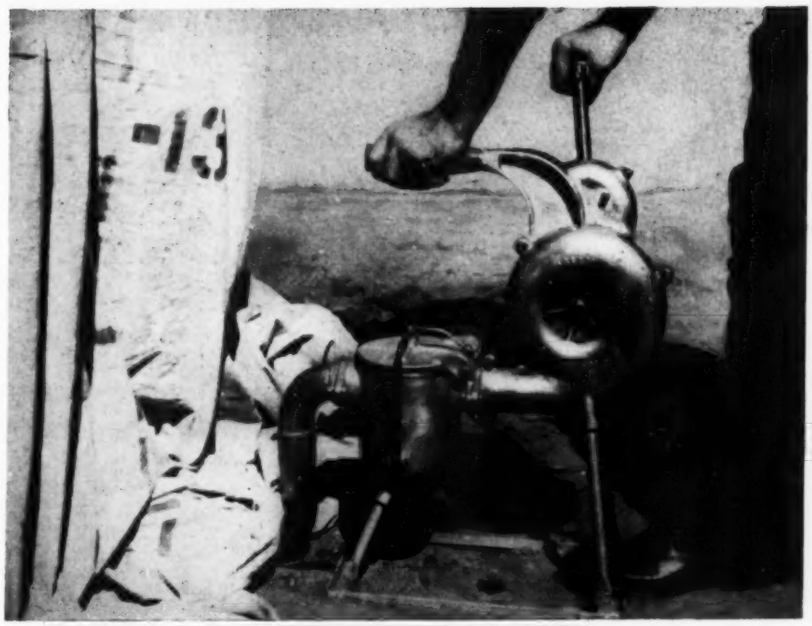
THE method of dust fumigation with "Cyanogas" was developed several years ago. In 1936, Professor Quayle of the Citrus Experiment Station at Riverside, California, hailed the cyanide dust fumigation method as one of the important advances in the art of fumigation. The earliest successful fumigation procedure was by the so-called "pot system." In this, sulphuric acid was measured out and added to water in a glazed earthenware pot. Then the weighed quantity of cyanide was dropped into the diluted suphuric acid and hydrocyanic acid gas was evolved.

The next important step was the development of a fumigation machine. This machine simplified the dosage application and general procedure. Sulphuric acid was carried in one compartment of the fumigation machine and cyanide solution in another compartment. A measured quantity of the cyanide solution was introduced into the acid chamber and the corresponding hydrocyanic acid gas was generated almost instantly. This machine had scarcely come into general use when liquid hydrocyanic acid was produced on a commercial basis. The advantages of the liquid were so many and obvious that previous methods of fumigation were rapidly replaced by the liquid HCN method.

"Cyanogas" Enters Picture

NEXT followed the "Cyanogas" or calcium cyanide dust fumigation method now in extensive use, and finding wider applications each year.

"Cyanogas" is calcium cyanide and has the very interesting property of decomposing rapidly on exposure to air, releasing hydrocyanic acid gas. "Cyanogas," as used for fumigation, is a fine grey powder. Since it deteriorates on exposure to air or moist-



After the measured dosage of "Cyanogas" has been placed in the hopper and the lid securely closed, the blower handle is turned by the operator at about 130 rpm. Operators become expert at judging time required to discharge given dosage. The hole is sealed immediately upon withdrawal of the blower pipe.

ure, it must be kept in air tight containers. So long as it is kept in these containers away from the air and moisture, it remains stable for long periods of time, even for years. If only a portion of the contents of a container are used at one time, the balance may be kept unimpaired by merely closing the container tightly again.

"Cyanogas" is not influenced by temperature, so it does not require cold storage or any special handling to avoid high temperatures. This is an advantage over liquid HCN for some localities and conditions. In fact, "Cyanogas" makes possible the use of hydrocyanic acid for fumigation purposes where liquid hydrocyanic acid would be impractical. Fumigation of citrus trees in several foreign countries is conducted entirely with "Cyanogas."

Application of "Cyanogas" is simple, and less complicated than liquid HCN. The trees are covered and measured in precisely the same manner as for liquid HCN. A special dosage chart for "Cyanogas" has been prepared in which the figures given are in ounces of "Cyanogas." Thus, the measurements around and over a tree are compared with the dosage chart, and the figure in the square corresponding to these measurements will be the number of ounces of "Cyanogas" dust which should be applied to that tree. In Australia, South Africa, and Egypt, where "Cyanogas" is used extensively, special dusters have been developed for application. For each tree, the proper quantity of the dust is placed in the dust applicator, and then this is blown out under the tree in a cloud like smoke. The residue is largely calcium hydroxide, or ordinary slaked lime, which is harmless.

Where less extensive fumigation operations are carried out, a very simple application system is in use. The weighed dosage of "Cyanogas" for a tree is placed in a small can which has been perforated and the dust is scattered thinly on the ground under the tree in a manner similar to the use of a salt shaker. By contact with the air and the soil, the HCN is readily released and diffuses through the tree. Since the HCN gas is evolved at once, the shaker can is mounted on a wooden handle so that the operator can distribute the dust quickly without exposing himself unduly to the fumes. This system has the advantage of keeping the dust on the ground and thus prevents the accumulation of the dust or its residue on the trees. It is sometimes desirable to keep the dust off the leaves and fruit.

"Cyanogas" fumigation has been especially successful with tents made from lighter materials such as drill and sheeting. For locations and conditions where problems would be involved in transportation, storage and handling of liquid HCN, or where limited operations would preclude the economical use of the liquid, "Cyanogas" affords a thoroughly economical, efficient and satisfactory fumigant.

Factors Involved in Fumigation

DURING summertime, fumigation is carried on almost entirely at night, because in daylight the normal photosynthesis going on in the leaves of the trees increases their sensitiveness and thus makes them more susceptible to cyanide injury. A large amount of fumigation is done during the late afternoon in daylight during the winter. For natural reasons the trees are not as active at that season and are able to withstand the cyanide. While a normal set of rules and regulations prevail as to conditions for the operation of fumigating crews, much depends upon the judgment of the foreman of each crew. From experience he is able to judge accurately the conditions suitable for work. This is usually more flexible than a written code.

Temperature is a very important factor in limiting fumigation work. Long experience has made it possible to specify upper and lower temperature limits within which successful work may be done. In the coastal areas of Southern California, fumigation is not started in the evening until the temperature has reached approximately 70°F. In the warm interior districts, work is done at temperatures up to 80°F. This upper temperature limit is established largely to prevent fumigation injury. Lower temperature limits have been placed at 45°F.. for the atomizer type of HCN applicators and 37°F. for the vaporizer type. The lower temperatue limits are established mostly on account of the inactivity of the

(*Turn to Page 69*)

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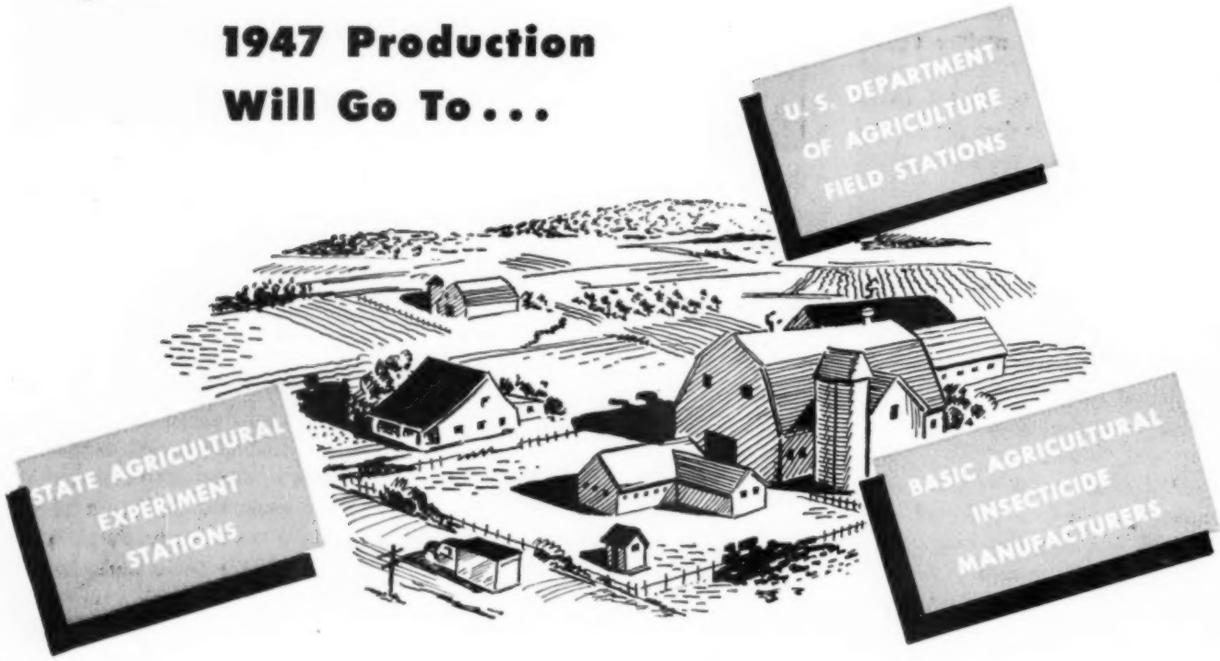

DURING 1947, Toxaphene* (chlorinated camphene) will be in limited supply and will be allotted as shown above. Distributors, dealers, and growers are requested to obtain finished and semi-finished Toxaphene concentrates from their regular agricultural insecticide manufacturers.

Federal, state, and other qualified scientists are running extensive field tests with this promising insecticide toxicant. Results, to date, indicate that Toxaphene is highly effective against cotton insects, the Mexican bean beetle, the sugarcane borer, grasshoppers, and other insects that plague the farmer.

Watch for further news of test results and distribution data on Toxaphene.

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NT7-4

Oil Sprays

By

P. J. Chapman and G. W. Pearce

New York State Agricultural Experiment Station, Geneva, N. Y.

PART II

The second and final installment of "Oil Sprays" appears herewith. The first section was published in the March, 1947 issue of AGRICULTURAL CHEMICALS.

THE present status and future of oils intended for use on the hardy fruits in the summer months is not clear. Prior to the introduction of DDT, summer oils were commonly employed in the control of codling moth and mites. At present, DDT alone has given such good control of the former insect that there has not seemed to be a need for any supplementary action such as could be supplied by a summer oil. While it would appear that oil would find a place for mite control in DDT programs, this usage may be limited. In the eastern part of the United States, foliage injury has resulted from combination treatments of oil and DDT. Problems of this kind may be subject to solution by adjustments in either DDT or oil formulations or both, but meanwhile the use of these products in combination must be placed in a questionable category.

In view of the foregoing, the writers hesitate to offer any specifications now for a summer type oil intended for use on deciduous fruits. This much may be said in general: The relationship between paraffinicity and efficiency applies as much to the summer oils as with dormant oils. Products having a U. R. of about 92% should be utilized while a viscosity of approximately 65 seconds Saybolt at 100°F. is indicated if a paraffinic product is involved. A straight run fraction of petroleum should be selected having a relatively narrow boiling range.

Emulsions

OILS are generally applied to fruit trees at present in the form of dilute emulsions. A grower has the choice either of purchasing a stock product in which the emulsifying agent is incorporated, or of buying the oil and emulsifier separately and preparing the emulsion himself in the spraying machine immediately before use. This latter procedure is commonly called "tank-mixing" (14). In the case of dormant oils, either practice has proved satisfactory in New York. Many of our growers continue to favor tank-mixing chiefly because the cost is lower.

Commercial spray oil stocks or concentrates are of two general types: concentrated emulsions and emulsible oils. The former are as the name implies, pre-formed emulsions in a concentrated state. These products have the appearance of a whitish paste and contain a stated amount of oil usually ranging from 75 to 85 per cent. Modern concentrated emulsions are so manufactured that they will flow freely thru the standard two inch outlet of the 30 and 55 gallon drums in which these products are sold. Emulsible oils consist of oil in which an emulsifying agent is dissolved. They usually resemble straight oil in appearance. These products are not emulsions in the state in which they are sold, but are expected to produce emulsions when added to water in the spray-tank.

No attempt is made here to present a digest of what is known generally about emulsions. For a brief, readable discussion of the principles, theories and practices involved, the reader is referred to a book published recently by Sutheim (15).

Although our knowledge is considerable on emulsions in general and spray oil emulsions in particular, we are not yet able to predict in advance, specifically, how a previously untried emulsifier will perform. One must resort for the most part to trial and error methods. This point should be kept in mind in reading the following comments. To gain the various objectives suggested, one often must simply "cut and try."

In spray oils the emulsifying agent may have three semi-independent assignments: (a) to form a satisfactor spray concentrate, (b) to promote the formation and even dispersion of an emulsion in the spray-tank and (c) to regulate the amount of oil deposited on the plant under treatment.

The second assignment will be considered first. Viewing the problem strictly from standpoint of producing uniform oil dispersion throughout the spray tank, it would be advantageous to have a highly stable emulsion. Unfortunately, stable emulsions are generally low oil depositors. To impart at least intermediate oil deposition properties to the emulsion some stability must be sacrificed. This is not a serious matter, for with the aid of a good agitation system such as exists in a modern spraying machine it is possible to achieve good oil dispersion of relatively unstable mixtures.

Emulsion stability is affected

TABLE III
Effect of the Emulsifier on Oil Deposition on Apple Bark

Per cent Oil	Emulsifier	Rate per 100 gals	Mg. oil deposited per sq. in. of bark
5	Lignin pitch	1 lb.	1.84
5	"	3 lb.	1.74
4	"	1 lb.	1.10
4	Bordeaux mixture	1-2-100	1.36
4	Blood Albumin	2 oz.	1.74
4	Sodium lauryl sulfate (1N-181)	1 oz.	2.51
4	"	2 oz.	1.97
4	"	4 oz.	1.25
4	Triethanolamine oleate	28 cc.	1.98
4	"	56 cc.	2.23
4	"	112 cc.	2.60
4	Bancroft clay	1 lb.	2.82
4	Skimmilk powder	½ lb.	4.07
4	Unknown (Commercial emulsion)		1.23
4	" "		1.85
4	" "		3.38

not only by the characteristics of the particular emulsifier used, but on its concentration as well. In general, emulsions may be expected to decrease in stability as the emulsifier concentration is reduced. Emulsion stability can also be greatly varied through the mechanics of preparation.

Just how closely emulsion stability is related to oil deposition properties is not clear. It will depend on how and when stability is measured. For example, our studies have shown that a series of emulsions may vary widely in stability in the spray tank, yet become quite stable and much alike after they have passed through the pump and spray gun. This is not surprising, since this action essentially duplicates the processing accomplished in an homogenizer. Generally speaking, however, the less stable (spray tank) emulsions may be expected to deposit more oils than stable products.

Oil Deposition

THE function of the emulsifier in controlling the amount of oil deposited by the spray on the plant under treatment has not been fully appreciated. One may readily vary the quantity of oil laid down 200 or 300% by varying emulsifiers or the concentration of a given emulsifier. (1,4,14) (See Table 3.) This is of paramount importance for there is a rather direct relationship between the quantity of oil deposited and the degree of insect control obtained.

Everyone concerned with spray oils should recognize that the performance of an oil spray is not determined by how many gallons of oil we put in the spray-tank but by how much of this oil is successfully deposited on the tree.

What then is wanted with respect to oil deposition? Probably no single standard will serve all purposes. Theoretically, the oil concentration in the spray may be reduced as the oil deposition rate of the emulsion is increased. This economic advantage, however, must be weighed against an accompanying loss of control on deposition rate. Heavy oil depositing emulsions are believed to lay down a somewhat uneven deposit. Thus oversprayed parts of the tree may receive too much oil and injury results.

For dormant oils, one may use an emulsion that has at least a moderately heavy deposition rate. Deciduous fruit trees are quite oil-tolerant during the dormant period and any small over-dosage of oil occasioned when applying the spray will be of little consequence. Where the oil deposit must be rigidly controlled, as with summer type oils generally, a more stable, lighter depositing emulsion is indicated.

From the foregoing it is evident that a spray oil formulation should properly be adjusted to a given deposition rate. This is being done in the case of some progressive oil processors. Others apparently have given little or no attention to this factor. It would seem helpful for everyone concerned if competing products could be standardized to the extent of meeting some generally accepted deposition standard. Then all could be advised for use at the same concentration. Thus a grower in using a 3% oil would lay down enough oil to kill the pest present, not half as much as may be needed, or for that matter, twice as much.

Manufacturers will probably always want to use their own emulsifying agents and special processing methods, and properly so. Adjustment of the product to meet a deposition standard however, would seem to be the place for subordinating individuality to gain a common advantage.

Our knowledge and experience has not as yet reached the point where specific deposit standards can be established for spray oil usage in all areas and for the various pests against which oil is used. To illustrate what might be done in this direction, a tentative standard of this type is offered in Table 4. In effect, this is in operation in New York State at present. Recommendations are based on a deposit falling within the "practical range" given in Table 4.

Various methods have been published, for the determination of the quanity of oil occurring on leaf, bark and fruit surfaces (5,8,9,12). These or other methods to be developed will be found useful in carrying out the foregoing objectives.

Emulsifiers

IN a sense there are a large number of substances that could be used as emulsifying agents for spray oils. And new materials having this potentiality are constantly being introduced. Selection of a product that embodies all of the properties desired in a spray oil emulsifier is something else again. This greatly narrows the field of choice.

The standards are much more

where an emulsifier is sought for the preparation of commercial stocks than in tank-mixing. For the latter, an inexpensive product is preferred; one that will produce an emulsion readily when the tank-mixing procedure is properly carried out. It must also be essentially unaffected by salts occurring in the spray water and must give good deposition on the plant. Probably a number of materials will meet this standard. In New York State, only two emulsifiers are now advised for tank-mixing dormant oils, namely, blood albumin and bordeaux mixture.

Blood albumin is advised for use at the rate of 2 oz. for each 100 gallons finished spray. Where dormant oils are applied after new growth has appeared, bordeaux mixture 2-4-100, or its equivalent in a commercial product, is favored. It will, in addition to emulsifying the oil, provide fungicidal protection.

Emulsifying agents employed in spray concentrates should have all of the qualities just given for tank-mix products and other qualities enumerated hereafter. Somewhat different standards will apply for the preparation of concentrated emulsions as against emulsible oil. In either case, however, the emulsifier should not be subject to appreciable chemical change nor to bacterial action under conditions existing in the finished product.

Considering the concentrated emulsions first, emulsifiers will be selected from among the water soluble or hydrophilic substances. In the past, various soaps, gums, clays, lignin pitch and ammonium caseinate have been employed. These appear to be giving way to various sulfated and sulfonated compositions derived from petroleum or by synthetic means. Sutheim (15) classifies some of these and lists examples of each.

In a concentrated emulsion a product of high oil content is desired —83% oil or higher—and yet one that will flow freely through a small outlet. The product should not stratify or separate on long storage and the emulsion should at least resist breaking through freezing. These objectives are difficult to attain. Selection of the proper emulsifying agent or combination of several is important but the mechanical means used to produce the product are fully as vital. It has been said that the production of a good concentrated emulsion is as much of an art as a science.

Oil soluble emulsifiers are employed in emulsible type spray oil concentrates. Those which have been used include petroleum sulfonates, diglycol oleate and similar products. A number of other possibilities are to be found among the various newer products mentioned in connection with the concentrated emulsions.

Theoretically, the emulsible type spray oil concentrate has many features to recommend it over the concentrated emulsion. Thus far, however, difficulty has been experienced in combining ready emulsification in the spray tank of such products with good oil deposition properties.

Emulsions may be formed where the oil is either in the discontinuous or continuous phase. With spray oils as they are generally used at present we are concerned with the former or so-called oil in water emulsions, indicated as O/W systems. The type formed is determined in part by the properties of the emulsifying agent used. Products producing the other type, that is W/O emulsions, or showing a tendency in this direction should be avoided for spray oil preparations. Sutheim (15) lists a number of emulsifying agents and classifies them with respect to this characteristic.

TABLE IV

Tentative Oil Deposit Standards for Dormant Oils in New York State. Maximum usage*

Oil type (See Table No. 2)	Oil deposit in mg. per sq. in. of bark surface		% Oil in spray. Deposition equivalent to blood albumin 2 oz/100 gals.
	minimum	practical range	
Regular	1.3	1.4 - 1.8	4.0
Superior	1.0	1.1 - 1.5	3.0

* The deposit that will kill the most oil-resistant pests in this area, namely, eggs of the fruit tree leaf roller, apple red bug and scurfy scale. Slightly lesser amounts are indicated for European red mite and considerably less for San Jose scale.

Conclusions

In the foregoing, the writers have presented some of the newer concepts regarding horticultural oil sprays and discussed problems involved in the formulation and use of such oils. Petroleum oils have proved highly useful in the insecticide field in the past. They should find important uses in the future. Certainly, in the opinion of the writers, the full potentialities for petroleum oils or more exactly, hydrocarbons, in the insecticide field have yet to be explored and evaluated.★★

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ZINC COMPOUND 38% Zn

Guaranteed 38% Zinc as Metallic

A Fertilizer Zinc Spray to correct Zinc deficiency in plant life

Figure 1

Zinc compound 38% Zn is composed of various components blended to give a uniform non-hardening product easier to handle than some zinc materials. Zinc deficient citrus leaves, such as those seen at the left (figure 1), containing only 35 ppm zinc dry weight, can be turned back to normal appearance (figure 2, below) by applications of Zinc Compound 38.

A typical dormant spray is as follows:

Lime Sulfur Solution	**2 gals.**
Wettable Sulfur	**10 lbs.**
Zinc Compound 38% Zn	**3 lbs.**
Water	**100 gals.**

Zinc Compound 38 can be used in any dormant spray application where other zinc compounds are satisfactory. If used with lime, usually one-half as much lime as zinc is preferred, but if DN Dry Mix is to be added, one-third as much lime as Zinc Compound 38 should be used.

MELANOSE, SCAB and NUTRITIONAL SPRAY

Use 2 to 3 lbs. Zinc Compound 38 per 100 gallons of spray containing copper and wettable sulfur, and half as much hydrated lime as Zinc Compound. Normal citrus leaves produced by an application of Zinc Compound 38, 85 ppm Zinc dry weight. (see figure 2).

Figure 2

SOIL APPLICATIONS

Although the usual forms of powdered zinc sulfate are not designed for correcting frenching of zinc deficiency when applied to sandy soils around zinc deficient trees, it has been found that when zinc compound was applied, it did not become insoluble so quickly.

It has also been found that frenched leaves can be turned green by applications of Zinc Compound 38, when it was included in a fertilizer mixture (1%ZnO) and applied to a slightly acid soil. The zinc content of the leaves was increased from 38 ppm dry weight, to 79 ppm dry weight by one application after four months.

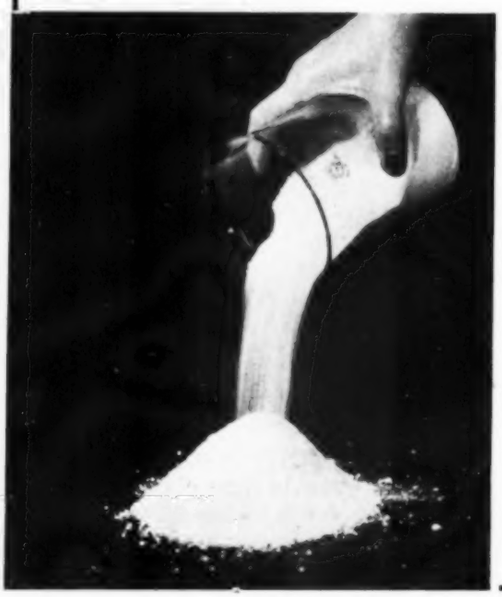

Figure 3

ZINC COMPOUND HANDLES EASILY ... does not get hard in the bag, does not get lumpy, and can be very easily weighed or measured for use. Can be stored from one season to the next, and will keep in good condition.

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Photo by Pacific Coast Nurseryman

Oliver E. Overseth*

President, California Fertilizer Association

STABLE and efficient agriculture depends upon the maintenance and improvement of the soil, and on supplies of raw materials essential to crop and livestock production. The fertilizer industry is only one of the several servants of agriculture, but the responsibility of this industry heads the list of suppliers. The use of commercial fertilizers, properly included with good soil management and efficient crop production practices, provide the grower with maximum returns for his labor and investment. We cannot afford to overlook Industry's obligation to supply the right kind and amount of fertilizer at the lowest price consistent with efficient management and reasonable profit.

Industrial research as an aid to the farmer is very important. It has been estimated that the amount spent in individual research projects of all industries exceeds the expenditures of Government and State research projects.

In 1940, the National Resources Planning Board found that 180 manufacturing industries were investing 2 per cent of the gross value of their products in research. To have equalled this average, the fertilizer industry in the United States would have spent 10 millon dollars for research in 1945. The amount actually spent by the fertilizer industry was much below this figure. The total spent by Government-State and Federal agencies for research in the fertilizer field probably fell considerably below this mark. It is apparent today the more that is learned in regard to the use of fertilizer, the greater the need becomes for further study and research. The field is so great that no one agency or organization can hope to do the job alone.

Fertilizer Economy

THE National Fertilizer Association in its 1939 survey found that the nine leading crops using fertilizers in the United States returned $4.15 for every dollar invested in fertilizer. The return for citrus fruits was $3.61. For all crops, including small grain, the figure was $3.60. If the return could be calculated on present day market prices for crops and the present cost of fertilizer, it would undoubtedly be much more favorable.

The amount of fertilizer that will be used in the United States during the next ten years will be determined by the farm income. Consumption of fertilizer in the past has been in direct relationship to farm income.

According to the United States Department of Agriculture, fertilizer prices at the farm in the spring of 1946 were only 22% above the 1910-14 base, while prices the farmer paid for all of his commodities, including fertilizer, increased 88% during the same period. It is obvious, therefore, that the difference between cost of fertilizers and the returns in the form of marketable crops was very much to the advantage of the farmer. This advantage stimulated the increased use of fertilizer to the extent that for the United States as a whole it has approximately doubled over prewar use. In California the consumption has more than doubled. Such a pronounced increase can be attributed only to satisfied customers and a realization from the farmer's viewpoint that it is very profitable for him to use larger quantities of commercial fertilizers.

Government in Business

THERE is no sound reasoning for governmental interference in fertilizer production during peacetime years. The industry is and has been developed on a free enterprise basis with ample funds for investment and facility for producing fertilizers to meet growing needs. This has been demonstrated during the past decade when production has doubled and the output today still falls short of the production capacity throughout the country. Problems of labor, transportation and material shortage caused by the war have resulted in some local shortages, but the industry's basic capacity to produce far surpasses the demands upon it. The fertilizer industry is capable of and willing to supply plant food for the essential needs of the country and no advantage whatsoever would follow Federal interference either in the production or marketing of fertilizer.

Manufacture of fertilizer is a highly competitive industry both in regard to supplying the

(*Turn to Page 63*)

*Excerpts from talk given at California Fertilizer Association meeting, Los Angeles, March 14.

Finely-ground Florida Limestone provides new commercial product

DILROC - A New Insecticide Diluent

By Mack Tyner

Research Engineer, U. of Florida Experiment Station, Gainesville, Florida

WIDESPREAD use of insecticide dusts in vast quantities has prompted the search for new and cheaper diluent materials available in large tonnages. The almost universal usefulness of DDT has required a diluent for its application that is chemically non-reactive and one which preferably may be used to aid in the DDT grinding operation.

The typical diluents for insecticides are the naturally occuring aluminum silicates, kaolin, pyrophyllite, feldspar and bentonite; the magnesium silicates, talc or soapstone; inert inorganics such as slate dust and gypsum; and the alkaline inorganics such as hydrated lime, dolomite and limestone.

The availability of fine size grinding machines[1] that give commercial production of finely powdered materials in the sub-sieve range has greatly increased the value of many natural products heretofore limited in usefulness because of the difficulties in obtaining the required fine particle size in commercial quantities. "Dilroc," or finely ground Florida limestone, is one of these new products which shows promise of being useful in several new fields.

The state of Florida has vast deposits of a soft friable limestone known locally as limerock. It is a very cheap raw material but is available at present only in bulk quantities at the mines. This limestone has been finely ground to produce a new insecticide diluent. In preparing the diluent material in the laboratory, the limerock from the mine was dried and run through a jaw crusher which reduced the 1 to 2 inch material to 3/8 inch maximum size. The next step was fine grinding of the material through a laboratory Raymond pulverizing mill. The final operation in processing the diluent was to air float the fine particles from the coarse grains by use of a Raymond air separator. The resultant fine powder was very uniform and free from coarse particles. This finely divided material has been given the name "Dilroc." DDT may be ground with this material in the preparation of the dust, thus solving the problem of dispersing the DDT raw material with the diluent.

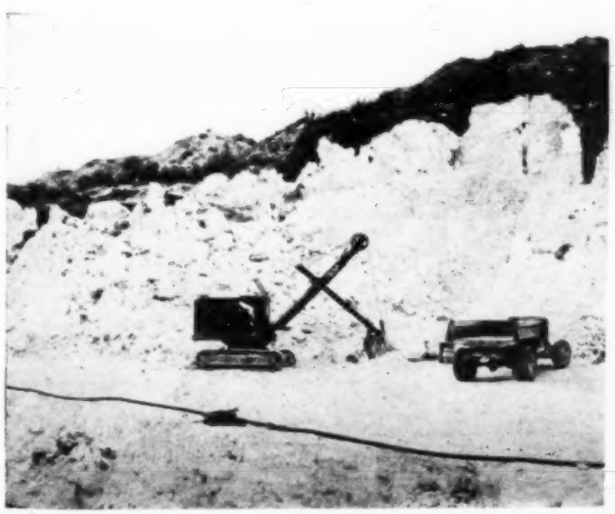
Lower left: Mining Florida limestone which when ground to fine granules may be used as insecticide diluent. Lower right: After being thoroughly pulverized, "Dilroc" makes suitable dispersant of DDT for agricultural use.

Properties of Diluents

WHENEVER a new material is proposed for use as an insecticide diluent, it is necessary to have tests available which will measure the important properties of such material. At the present time there are no standard procedures for evaluating the potential usefulness of a new diluent. The tests commonly employed by the U.S. Department of Agriculture, Bureau of Entomology and Plant Quarantine, for evaluating diluents are air permeation (particle size), bulk density, and dry sieve test.[2] Other properties that might be

[1] C. E. Berry, "Modern Machines for Dry Size Reduction in the Fine Size Range." Washington Spring Meeting of ASTM, March 4, 1941.

[2] R. C. Roark, Private Communication. April 29, 1946.



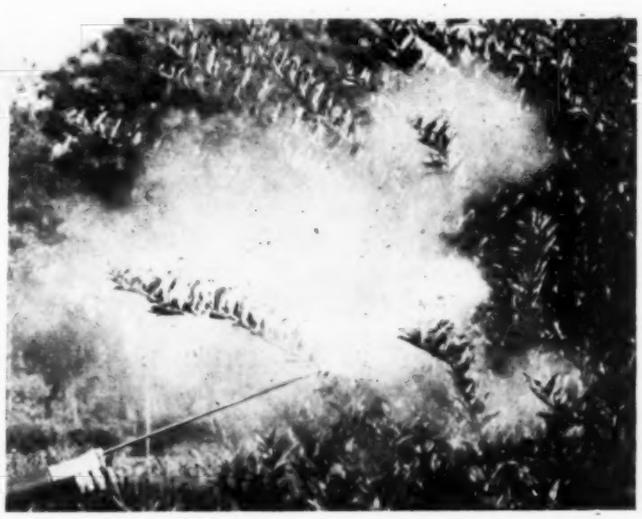


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TABLE I
Particle Size and Siftability of Common Diluents

Material	Particle Size Surface mean diameter	Siftability % passing 100 mesh
Talcs and pyrophyllite	3 microns	90-100
Clays	2 microns	80-100
"Dilroc"	2.8 microns	95-100

important in many situations are oil absorption and reactivity with specific insecticides.

1. Particle size. There are many approaches to the measurement of particle size of materials finer than the finest screens.[3] The Bureau of Entomology and Plant Quarantine, U.S.D.A. uses the air permeation method and obtains a measurement known as "surface-mean diameter of particle." Sedimentation methods as are used here (ASTM Designation D422-39 "Mechanical Analysis of Soils") give an "effective" diameter of particle and the particle size distribution of the material. The "surface mean diameter" may be calculated from the particle size distribution by taking the reciprocal of the sum of the weight percentages in each fraction divided by the mean particle size of that fraction in microns.

Sometimes a dry sieve test is used for fine materials to give a rough measure of particle size. This sieve test is not so much a measure of particle size as it is of siftability, a property of fine powders which is related to both fineness and flowability of the powder. Siftability is measured as the percentage of material passing the 100 mesh sieve when a 50 gram sample is screened for 15 minutes on the "Ro-Top" machine.

There are no accepted size specifications for the fineness of diluent materials but several attempts to set up specifications have been made. Gooden[4] concluded that suitable specifications for a given fine powder should consist of a specification as to surface-mean diameter and an approximate maximum limit of diameter; in addition, he suggested that the dry sieve test may also be included.

In Table I the particle size and siftability of "Dilroc" are contrasted with these properties of the accepted clays and talcs used as diluents. It has been shown that 10% DDT—"Dilroc" mixtures can be applied using an ordinary hand duster.

2. Bulk Density. Bulk density is important from the view of shipping and storage space as well as dispersion and dusting in the dust guns. It depends upon the shape of the particles, their density, and arrangement in the measuring container. Bulk density is determined by measuring the weight of fine material required to fill a specified container when the container is filled in a standard manner. The bulk density of a fine powder decreases as the particle size decreases. The bulk density of some of the common diluents is given in Table II.

3. Oil Absorption. The oil absorption value of a fine powder is the amount of raw linseed oil (lbs. per 100 lbs. powder) required to produce a very stiff, putty-like, paste. Its practical importance for diluents lies in its use to predict whether or not an oil containing insecticidal dust will tend to cake on storage. Many insecticidal dusts do not contain oil, solvents or stabilizers but some, such as pyrethrins or rotenone extracts, contain solvents and oils which may or may not volatilize during processing. The standard method used for measuring oil absorption is the ASTM Designation: D281-31, "Oil Absorption of Pigments." The method is a rub-out method in which a weight of powder is taken and raw linseed oil incorporated dropwise until a standard consistency is obtained. The comparison of oil absorption values for various diluents is shown in Table III.

TABLE II
Bulk Density of Common Diluents

Material	Bulk Density lbs. per cu. ft.
Talcs and pyrophyllite	28-30
Clays	25-30
"Dilroc"	50-60

4. Reactivity of Diluent. Insecticide diluents may be inert or active as regards compatability with various insecticides. This reaction with the insecticide is due to physical characteristics such as particle size and absorption, or to chemical properties such as catalysis and acidity or alkalinity of the material. For example, certain clays absorb nicotine from nicotine-clay dusts to such an extent that the mixture becomes less useful

(*Turn to Page 65*)

[3] ASTM, "Symposium on New Methods for Particle Size Determination in the Subsieve Range." Washington Spring Meeting of ASTM, March 4, 1941.

[4] E. L. Gooden, "Size Specifications for Fine Powders," *J.* of Economic Entomology, *37*, (2) 204, 1944.

TABLE III
Oil Absorption Values of Various Materials

Material	Oil Absorption Value (lbs. oil per 100 lbs.)
Talcs and pyrophyllite	16-30*
Various clays	25-35*
"Dilroc"	17-20

* H. A. Gardner, "Physical and Chemical Examination of Paints, Varnishes, Lacquers and Colors."

The Listening Post

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey.

By Paul R. Miller

CELERY Mosaic. Celery has been grown on the mucklands of Palm Beach County, Florida, for about twenty years. The virus disease, mosaic, has increased in amount along with the increasing importance of the crop, but did not produce serious effects until about ten years ago when heavy losses occurred in some older fields. Severe damage is associated with the presence of weed hosts of the virus, in fields and seedbed areas, especially the day flower, *Commelina longicaulis,* which is rare on newly cleared lands, but eventually becomes established. It propagates vegetatively and is usually infected with the virus, hence it is an excellent source of infection for the celery crop. On one farm where celery has been grown for fifteen successive years, the disease increased so much between 1938 and 1943 that it appeared that the crop could not be grown if the disease were not controlled.

A program of weed control around the seedbed area and in the fields instituted in 1944 has been extended and intensified each succeeding year. During the last two years it has been aided immensely by the use of 2,4-D sprays. During the current year, this same farm, growing 200 acres of celery, has lost less than 1 percent of the crop to mosaic, the only loss being in one of the outside fields bordering a canal bank where some *Commelina* still grows. On nearby weedy farms mosaic infection amounted to nearly 100 percent, with losses running as high as 300 crates per acre.

The new insecticides have played an important role in control of the aphid that transmits the virus from infected to healthy plants. Benzene hexachloride and the emulsified DDT concentrate have been found very useful. However, since even one aphid can transmit the virus, it would be difficult to control mosaic by controlling the insects alone.

Tobacco Blue Mold in Georgia and Florida

THE first 1947 symptoms of tobacco blue mold in Georgia were observed in two widely separated plant beds, January 28. Only a few plants were affected at the time and no damage had been done in either bed. The largest plants in these beds were the size of a fifty-cent piece but most of them were much smaller. Some growers at that time had started spraying and dusting with "Fermate." November and December were unusually dry, and plant beds sown in early December were too dry to permit germination before the first of January. The majority of Georgia beds were sown the last week in December and the week following. Weather conditions were ideal for mold development throughout January.

The frequent showers and almost continuous cloudy warm weather were also favorable for quick germination of tobacco seeds. Most growers reported excellent stands of plants. By February 15 the disease had developed in many scattered beds throughout the main part of the Georgia belt. In nearly all affected beds (new and old alike) symptoms were confined to plants in smaller patches, usually only one to a bed. Growers generally had already started spraying and dusting with "Fermate." Enough of this material is already in the hands of the majority of the growers to meet their 1947 needs. However, in some cases manufacturers are unable to fill orders.

Blue mold was first observed in the Northern part of the cigar-wrapper area February 13. This is the earliest mold observation ever made in the cigar-area. Below freezing temperatures were recorded at Tifton during eight consecutive days, February 5 to 12, inclusive. At night the ground froze under the covers of unprotected beds in exposed places, and here plant loss exceeded possibly 25%. Probably 15% of the Georgia plants were killed by cold. Initial mold symptoms developed at the close of the cold wave in both protected and unprotected beds, the disease being observed in badly frost-bitten plants 24 hours after freezing temperatures subsided.

In Florida the first specimens of tobacco seedlings showing blue mold were observed January 30. The seedlings were in advanced 4-leaf stage, probably smaller than average for this area. The temperature had been favorable all winter for development of blue mold. Although rainfall had been light, the beds had been watered and heavy fogs were general. By February 10 the disease was found in some cases to have spread from primary infected beds to new ones. Size of plants in infected beds varied from 4-leaf stage to 1½ inches high. Practically all plants in a few beds were infected and many killed. Few farmers at that time had started control measures.

Tomato and Potato Late Blight in Florida

IN the lower east coast area all potato and tomato plants were severely damaged or killed during the week of February 8 and the first of the week of February 15. Before the freezes, late blight had been brought pretty well under control by thorough applications of "Dithane," copper

sprays or dusts, or combinations applied at 3 to 5 day intervals. Some late plantings of potatoes became infected soon after the plants emerged but frequent sprayings had checked the disease.

Most fall plantings in the Everglades area have been harvested. Late blight and rains caused heavy reduction in yields. Since rains interfered with the spray program, there was not much opportunity to obtain information on effectiveness of fungicides.

Practically all the potatoes in the Hastings area were killed, consequently there will be no opportunity for further reports on late blight until other plants develop.

Less cold damage on both potato and tomato occurred in the west coast area around Ft. Myers and Bradenton. Although the disease is present in that area, it had not become generally prevalent in the tomato plantings for the spring crop. The growers are spraying and dusting according to a regular schedule.

Insect Conditions, Late February, Early March

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Haeussler is in charge of Insect Pest Survey and Information, Agric. Research Adm., B. E. & P. Q., U.S.D.A. His observations are based on latest reports from collaborators in the department's country-wide pest surveys.

By G. J. Haeussler

A cold wave, with sub-freezing temperatures, which occurred over much of the South during the first half of February, caused severe damage to many vegetable crops in South Carolina, Georgia, Florida, and Alabama and greatly reduced insect populations and damage in those states and in Louisiana.

Cabbage caterpillars practically dropped out of the picture in the southeastern states. Occasional larvae of the diamondback moth were reported on cabbage in Georgia and Alabama toward the first of March and occasional cabbage loopers were still reported in the southern sections of Georgia. At about that same time the imported cabbageworm, and to a lesser extent the cabbage looper and larvae of the diamond back moth, were causing considerable injury to maturing cabbage in Jefferson and St. John Parishes, Louisiana. Cabbage caterpillar infestations were very light in southern California throughout February and early March and did not cause appreciable damage.

The vegetable weevil caused slight injury to tobacco plant beds in Florida late in February, and damaged turnips to some extent in parts of Florida and Georgia and parsley to a lesser extent in Georgia into early March. Occasional larvae of this insect were still reported from South Carolina on spinach shortly after the middle of February.

Early in March, occasional adults of the spotted cucumber beetle were present on turnips in Alabama and this species and the banded cucumber beetle were found on turnips and other hardy winter vegetables in Louisiana.

Populations of the onion thrips began to build up toward the end of February on early onions in the Coachella Valley of California, running as high as 20 per plant in some fields. Over 40 per plant were present on seed onions in the Yucaipa area. By March 1 heavy infestations on onions in many fields were reported from southern Texas and a light infestation on onions, garlic, and leek was reported from southern Louisiana. Infestations of the beet armyworm and alfalfa looper on lettuce in Ventura County, Calif. were sufficiently heavy in early March to require insecticide treatment.

In the southeastern states only small numbers of aphids have been reported on cole crops since the freezing weather in early February. Cabbage aphids were very abundant in parts of southeastern Louisiana toward the end of February and were beginning to appear at that time on late cabbage in southern Texas. They were generally present in most southern California fields during late February and early March, but caused little damage except in some parts of Ventura County. The turnip aphid caused considerable injury to turnips in parts of southeastern Louisiana in late February.

A pyrethrum-containing dust mixture was used as a substitute for nicotine to control aphids on lettuce in southern Texas around the middle of February. Shortly thereafter hexaethyl tetraphosphate and benzene hexachloride dusts were used to control increasing aphid populations in fields of young lettuce planted for spring harvest in the Salt River Valley of Arizona. Hexaethyl tetraphosphate was also used during late February in Orange County, California to combat aphids on celery.

Light to moderate infestations of cucumber beetles and the serpentine leaf miner occurred on young bean plants in Dade County, Florida early in March.★★

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Potash Use Increases

The total of 923,127 tons of potash delivered in 1946 set a new high record, according to the American Potash Institute, Washington, D. C. The 1946 deliveries were 54,941 tons more than the preceeding year, or an increase of 6.3 percent. It was the twelfth consecutive year that deliveries had exceeded those of the preceeding year.

Deliveries for agricultural purposes in U. S. totaled 763,590 tons, an increase of 68,514 tons over 1945. The State of Georgia received 70,709 tons, followed in order by Illinois, Ohio, Florida, Virginia and North Carolina. Each state took more than 55,000 tons. Illinois incidentally, advanced from fifth place to second in 1946, indicative of increased use of fertilizer materials in the midwest.

Comments....

By Dr. Alvin J. Cox

This column by Dr. Cox appears as a regular feature of AGRICULTURAL CHEMICALS. Dr. Cox formerly was successively Physical Chemist, Chief Chemist, Assistant Director, and Director of the Bureau of Science, Government of the Philippines. He was appointed Chief, Bureau of Chemistry, California State Dept. Agriculture in 1932, retiring in 1945.

Editor's Note: Dr. Cox this month reports highlights of discussions at the California Entomology Club meeting of February 28, 1947, at Sacramento. This group meets four times annually, as it has done for the past 20 years. Present at this meeting were about 170 persons, numbering representatives of industry as well as officials and investigators of the State. The gathering is described as being valuable in providing a common meeting ground for both commercial and technical minds. Following are digests of remarks made by representatives of the firms which manufacture the products discussed at the meeting.

SEVEN insecticides were discussed at length at the California Entomological meeting held in Sacramento. Following is a digest of what was said: Leo R. Gardner of California Spray Chemical Corporation spoke on "Bladan," also known as "HETP." "Bladan" is a German trademark. The chemical compound is *hexaethyl tetraphosphate* ($C_{12}H_{30}O_{13}P_4$). It is a yellowish liquid, specific gravity 1.3, solidifying at approximately —40°C. It is miscible with water and many organic solvents, but not with kerosene or petroleum spray oils. The pure compound is stable but hygroscopic and hydrolyzes within a few hours. Products containing hexaethyl tetraphosphate are now in commercial production for liquid spraying and for dusting, and the material is available in substantially large commercial volume under such brand names as "Vapotone," "Killer," "Hexidust," "Tetra-ChemDust" and "Killer Dust." Dusts and sprays are effective for control of red spider, aphids, immature scale, thrips, leaf hoppers, mealybugs, and it appears to be useful for a number of purposes for which nicotine is used. It does not kill mite eggs. The spray formulation is generally a 50% liquid concentrate for use at 1 to 800 water dilution. Sprays should be used promptly after mixing, and dusts should be applied within 10 days of manufacture, depending on advice of the manufacturer. The price of such products is in the general range of nicotine and the amount available in 1947 should alleviate the nicotine shortage. The material is effective at cool temperatures as well as during fairly high ones. Inasmuch as the chemical decomposes rapidly, residues on treated food crops probably do not present a health hazard. The compound is irritating to skin and contact should be avoided. Injury has been noted on cyclamen and tomatoes in greenhouses, but on no other plants. Application is conveniently made in greenhouses by the fog or mist spray methods. It is not compatible with alkaline materials, and should not be applied over fresh residues of Bordeaux mixture.

R. S. Glover of Hercules Powder Company, spoke on "Toxaphene" formerly known by the laboratory number "3956." It is a *chlorinated camphene* with the approximate empirical formula $C_{10}H_{10}Cl_8$. It is a cream colored, waxy solid with a mild piney odor. It melts in the range of 65 to 90°C. and has a density of 1.6. It is readily soluble in common organic solvents, an obvious advantage in formulation for insecticidal use, and particularly for insecticide concentrates. It can be formulated in oil soluble concentrates and water suspensions. It is similar to DDT in methods of use and effectiveness against common household insects, somewhat slower in producing paralysis, but can be combined with "Thanite" for quick knockdown. It has residual action and is a promising stomach poison and contact poison in sprays and dusts against a number of agricultural pests, such as cotton bollworm, cotton fleahopper, cotton aphis, tobacco hornworm, corn earworm, cabbage aphis, army worm, and grasshoppers. It did not irritate skin in patch tests, and was of the same order of toxicity as DDT when administered in corn oil. Mr. Glover reported that the only observed plant injury was on cucurbits.

A. F. Kirkpatrick of American Cynamid Company spoke on "899," which is the laboratory number for *di-2-ethylhexyl phthalate* ($C_6H_4(COO.CH_2C_2H_5CHC_4H_9)_2$). The chemical has no trade name, is not registered as an economic poison, and is not available as an insecticide except for experimental use, although it is manufactured for use as a plasticizer. It is a stable, straw-colored, nonvolatile viscous liquid. It is less than 3% soluble in water. It has possible use as a solvent for DDT and for botanicals such as rotenone and pyrethrins. It has prolonged residual action, and shows value as a contact

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acaricide against red spider and bud mite on citrus. Most of the experimental work has been done on citrus, using one quart in water to make 100 gallons. Vatsol-OT one part in 1000 and blood albumen are used for making quick breaking emulsions. No injury to citrus trees has resulted from its use at this dosage. Its use in dusts has received only limited trial.

Although scheduled, C. C. James of E. I. duPont de Nemours & Co., Inc., was not present to speak on "Methoxy DDT."

Dr. L. L. Isenhour (Rohm and Haas Company) spoke on "RHothane," also sometimes called "DDD."

The chemical compound is *dichloro diphenyl dichloroethane*, and differs from DDT in that two instead of three chlorine atoms are attached to the second carbon atom of the ethane group. It may be slightly more stable under conditions of high temperature and light, and may give slightly more residual action in the field. The technical material is primarily the para para isomer. The purified isomer melts at 109° to 110°C.

Technical dichloro diphenyl dichloroethane is now being produced commercially under the trade name "Rhothane D-3." "Rhothane AD-50" is the 50% dust concentrate, "RHothane WP-50" the wettable powder, "RHothane R-30" Solution the solvent concentrate, and "25% RHothane Emulsion Concentrate" which is the emulsible solvent solution. It is to be marketed for the same uses as DDT and at comparable dosages, being slightly more toxic than DDT to some insect species and slightly less to others.

Reports on 1946 field tests indicate that "RHothane" dusts are superior to DDT and other new insecticides for control of corn ear worm, tomato fruit worm, tomato horn worm, and sugar beet army worm. 3% "RHothane" dust was reported to have given 92% control of corn ear worm. Independent reports from four different sources indicate dichloro diphenyl dichloroethane to have a low order of toxicity to warm blooded animals.

Dr. E. E. Wilson, Plant Pathologist, University of California Experiment Station, Davis, spoke on *sodium pentachlorophenate* and some other chemicals now on the market for control of brown rot and shot hole fungus on deciduous trees. He mentioned two approaches: (1) chemical protection and (2) destruction of the fungus and spores. Dr. Wilson discussed fungus control which involves treatment of the dormant tree to kill the spores overwintering without injury to the bark or buds. He stated that it is possible to prevent development of fungus spores and to destroy spores already present.

Calcium arsenite has been successfully used on apricots in California, but it has done damage to almonds. Work is now being carried on with various chlorinated phenols and allied compounds. The sodium salts are more effective than the phenols themselves. He reported that tetra- and penta-chlorophenates are more toxic to spores than trichloro and lower phenates. Use of sodium pentachlorophenate at 4 pounds per 100 gallons water in January and Bordeaux as a pre-bloom spray on apricots gave 88% control. However, there is not yet sufficient information to permit general recommendations.

R. W. Underhill of Dow Chemical Company spoke on "K1875" which is the code name for *di (4 chlorophenoxy)* methane with the empirical formula $C_{13}H_{10}O_2Cl_2$. It was investigated by R. B. Korsmeier at the University of Calif. Citrus Experiment Station in 1944, under the direction of Dr. A. M. Boyce. It shows promise as an insecticide and meticide. It is not registered for sale, and there will be none this year. Production is in the pilot plant stage and commercial production is planned for 1948. The compound is a solid, chemically stable, slightly soluble in water, and appears to have no fumigant action. Four percent is soluble in kerosene with heat, but it stays in upon cooling. It is much more soluble in other organic solvents. It has certain qualities which are believed to make it outstanding. It can be used as a water suspension (with or without oil) dissolved in oil or other organic solvent, or in dust formulations. One pound per 100 gallons water for a spray and 4% dusts have been effective against red spiders and mites. Most of the experimental work has been done on citrus.

The material at 2/3 pound per 100 gallons water killed red mite eggs in cage tests. It was effective for 60 days in the laboratory and for nearly half as long in the field. It is claimed to be a more effective mosquito larvacide than DDT in marshes and under acid conditions. No data are available on toxicity to human beings, but the subject is being investigated.

Dr. Kenneth Maxwell of Chemurgic Corporation spoke on "HCH" sometimes also referred to as benzene hexachloride, "666," "BHC," or "HCC." The chemical compound is *1, 2, 3, 4, 5, 6—hexachlorocylohexane* with the empirical formula $C_6H_6Cl_6$. At least 5 patents have been issued covering methods of production, but no patent has been issued with regard to use as an insecticide. It is an amorphous solid consisting of 5 main isomers. Approximate proportions of isomers in the crude chemical are: Alpha 70%; Gamma 12%; and the remainder comprised of Beta, Delta and Epsilon isomers and impurities. The insecticidal properties were discovered in France in 1941, and independently in England in 1942 where the principal action was ascribed to the gamma isomer and use against agricultural pests was developed. Its unpleasant odor has retarded development of its use, but the product is now said to be more refined. In general it is considered for the same uses as DDT, but it is effective against a number of insects poorly controlled by DDT. Its known commercial uses include control of cockroaches, bedbugs, flies, Colorado potato beetle, turnip flea beetles, several species of aphids, plum curculio, grasshoppers, crickets and wireworms. From ½ to 1 pound per acre well disced into the soil has given control of wireworms. On account of danger of imparting its unpleasant odor to food plants, it should not be used in

(*Turn to Page 65*)

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Westvaco CHEMICALS

Raw Material Markets . .

THE supply picture has changed but little since last month's report. Both insecticide and fertilizer fields continue to be faced with troubles of various sorts from a number of sources. The fertilizer outlook has brightened somewhat, however, since a recent government directive rescinding the order for the fertilizer industry to return 300 tankcars leased from the army. The army will receive tankcars from other branches of the chemical industry, and the fertilizer trade may have the use of petroleum tankcars when fuel needs decrease.

Uncertainty characterizes the insecticide supply situation. As in the case of fertilizer, the distribution of insecticides is hampered by a lack of transportation facilities. A further bottleneck lies in the supply of suitable containers for insecticidal materials. The admonition to place orders as soon as possible is still being sounded in the industry.

All the arsenicals, with the lone exception of paris green, are in tight supply. White arsenic imports during 1946 were three percent below the total for the previous year; 27,506,000 pounds against 28,496,000 in 1945. However, future years may see a more adequate supply from Sweden since refining facilities there are being expanded at the present time. Stocks of crude arsenic in that country are practically unlimited.

Calcium arsenate is also tight, although 1946 production was 32 percent higher than the previous year. Lead arsenate is likewise tight, but this situation is at least partly accounted for by the fact that 1946 production was considerably less than the output of the previous year.

Pyrethrum, on the other hand, is expected to remain in good supply throughout 1947. Imports of the flower during 1946 were 7 percent above the previous year. Negotiations between American importers of pyrethrum and the Kenya Farmers Association are moving toward settlement of a testing and pricing controversy covering some 1946 shipments. A substantial portion of early 1946 shipments failed to meet the standard of 1.3 pyrethrum content, it was stated by the importers, but it appears that the matter may be settled shortly.

The over-all supply of rotenone seems adequate, but the critical question appears to lie in the matter of distribution ... whether or not necessary quantities of the material will be available at the proper time in the areas where they are needed. Sudden price advances which came at the end of OPA ceilings, are still effective and insecticide manufacturers have been reluctant to accumulate large inventories of raw material or finished dusts. The current price is expected to remain unchanged throughout this season, but industry spokesmen have indicated that they expect quotations to drop somewhat next year. One import firm representative possibly expressed the attidude of the industry when he stated, "... for this season we must depend upon root which has already been shipped from South America, or will be shipped within the next few weeks, all of which ... had to be obtained at the current high price."

The supply of DDT is expected to remain tight throughout 1947, and a shortage may develop if unusual needs occur. Production is reportedly sold through June. The output is good, but the demand is extremely heavy by comparison.

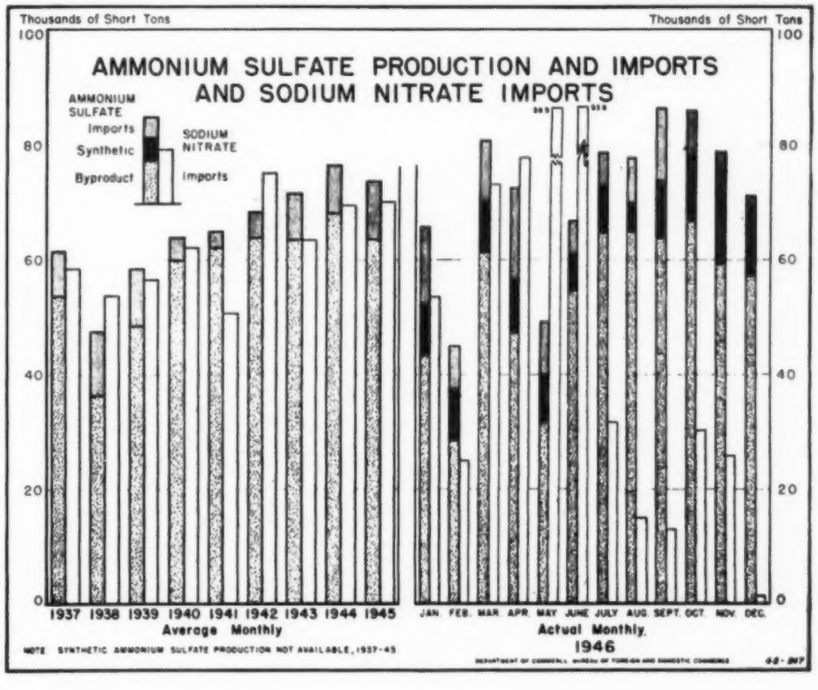
Nicotine supplies continue to remain considerably short of meeting the demand for 1947. The domestic shortage was reflected during 1946 in a sharp curtailment of exports of nicotine sulfate. Only 171,000 pounds were shipped out of the U. S. during the year, compared to 404,000 pounds in 1945.

Severe shortage of paradichlorobenzene has forced some major producers of this material to allocate output in order to keep distribution on an equitable basis. At the same time, however, exports in 1946 were nearly double the tonnage of 1945.

Fertilizers

BOTH production and use of fertilizer materials in the U. S. continue to increase to a marked degree. Tax tag sales, one of the best indicators of retail volume in January were 7 percent above the same month a year ago. The total for

(*Turn to Page 64*)



Technical Briefs

"Toxaphene" Evaluated

"Toxaphene," a new insecticide manufactured by Hercules Powder Co., Wilmington, Del., is the subject of a technical bulletin recently published by the University of Delaware. The booklet, designated as "Bulletin No. 264, Technical No. 36," is available from the University, Newark, Del.

The authors of the booklet, W. Leroy Parker and John H. Beacher summarize their experiments with "Toxaphene" as follows: "Toxaphene," a chlorinated terpene hydrocarbon with insecticidal properties and previously identified as "3956," is composed of technical chlorinated camphene and, for purpose of insecticide labeling, is considered to be 100 percent active ingredient. The technical and insecticide grade is a cream-colored, waxy solid with a mild piney odor. It contains 67 to 69 percent chlorine, melts in the range of 65° to 90° C. and has a density of 1.6. "Toxaphene" is very soluble in common organic solvents. This characteristic is highly advantageous in the formulation of liquid insecticides and insecticide concentrates. Like chlorinated hydrocarbons of this type, "Toxaphene" slowly evolves HCl upon heating, the rate depending upon temperature and the amount of catalytic impurities. "Toxaphene" and its solutions slowly liberate HCl upon exposure to ultraviolet light. Solutions of "Toxaphene" in deodorized kerosenes and aromatic hydrocarbons show no color formation upon exposure to sunlight or after storage at temperatures of 20° to 55° C. for over six weeks. "Toxaphene" in solid form may be stored for at least a year without deterioriation. Solutions can be stored in suitable containers for an equal period of time.

"Toxaphene" is toxic to household insect pests in space-spray formulations and as a residual insecticide. Like DDT, "Toxaphene" is relatively slow in action; therefore, space-spray formulations require a paralytic agent, such as "Thanite" (isobornyl thiocyanoacetate), to assure rapid and complete knockdown. High kills with low concentrations of "Toxaphene" are obtained in the case of the house fly, the German cockroach, the bedbug, and certain fabric pests; the black carpet beetle, the furniture carpet beetle, and the webbing clothes moth.

The role of "Toxaphene" as an agricultural insecticide requires further evaluation. Preliminary tests have shown the material to be equally as toxic as DDT to the potato leaf hopper, as effective as rotenone against the Mexican bean beetle, and promising for control of codling moth.

"Toxaphene" is phytotoxic to cucurbits, and, thus far, this is the only instance of severe plant injury reported for practical dosage levels.

"Toxaphene" is compatible with most fungicides and insecticides. In common with DDT, "Toxaphene" has one labile chlorine atom and is attacked by bases; therefore, strongly alkaline materials should be avoided in "Toxaphene" formulations.

Toxity to warm-blooded animals has not been fully established. Until complete information is available, it should be treated as a toxic material.

Control of Fleas on Chickens

Thorough coating of the nests, roosts, and floors of chicken houses with 10 percent DDT dust, controls the sticktight flea. The chickens need not be dusted. R. B. Eads. *J. Econ. Entomol.* 39, 659-60.

•

Treating Sheep with DDT

The biting sheep louse, *Trichodectus ovis*, which causes sheep to lose weight and wool, is controlled by dipping the animals in a DDT-pine oil mixture, formulated as follows: One part of technical DDT is dissolved in 5 parts of water-miscible pine oil (U. S. Navy specifications CS 69-38) by warming 10 pints of this mixture in 100 gallons of water. The dip contains about 0.2 per cent of DDT. This mixture will not make a satisfactory emulsion in alkaline aqueous solution. An animal is thoroughly wetted by a single submergence. H. E. Parish and C. A. Rude. *J. Econ. Entomol.* 39, 546 (1946).

•

DDT for Seed Treatment

Dusts containing 2.5-20 per cent DDT and pyrophyllite, and applied at 1 ounce per bushel of seed, controlled 8 species of stored-product insects in 15 kinds of seed. Dusts containing less than 2.5 per cent DDT were not completely effective. Seeds treated with dusts containing 5-20 per cent DDT grew satisfactorily when tested in a standard seed germinator. The seeds tested included wheat, sweetcorn, barley, field corn, squash, popcorn, ming bean, lettuce, beans, muskmelon, cucumber, oats, watermelon, tomato, and peas. M. D. Farrar and J. M. Wright. *J. Econ. Entomol.* 39, 520-2 (1946).

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Canadian Agri. Report

A report of the Canadian Minister of Agriculture, recently issued by James G. Gardner, Minister of Agriculture, covers all phases of agricultural interest, including discussions on botany and plant pathology, entomology, weed killers, horticulture, and fertilizers.

Extensive investigations into DDT, carried out in orchard experiments in Nova Scotia, British Columbia and Ontario, brought the conclusion that "DDT is highly effective for codling moth control but that its use alone in effective amounts leads to very serious outbreaks of mites, European red mite, and Pacific mite" in various provinces. DDT was also found effective in control of pear thrips in B. B., and DDT dusts gave "outstanding control" of black army cutworm, strawberry weevil and cranberry fruit worm. Pear psylla and apple sawfly were listed as "very resistant" to DDT.

Limited experiments were

made with benzene hexachloride, but the material appeared to be more toxic than DDT in a number of instances. It was particularly effective against the pear psylla, but was considerably less persistent than DDT. Initial experiments and demonstrations with cryolite made in Canada were conducted in 1945, the report states. The product, which was micronized in order to reduce particle size, proved to be "as satisfactory for codling moth control as the products at present on the market."

Reports on the use of 2,4-D indicate that a number of Canada's weed pests can be controlled with this material. Russian knapweed, hoary cress and leafy spurge are among the better known weeds controlled by 2,4-D. Several applications appear to be necessary to kill Canada thistle and field bindweed, but one application was lethal to annuals and shallow-rooted perennial weeds. "The results of one year's experiments have supplied convincing evidence that this new weed killer promises to be the most helpful ally in the fight against weeds that has yet been discovered," the report states.

•

Yam Beans Studied

The relationship between origin, chemical analyses, and insecticidal value of 31 yam bean samples have been studied in recent tests with Mexican bean beetle larvae. Significant correlations were found between toxicity and resin content, rotenone content, and three colorimetric analytical values. Neither the oil content nor six compounds other than rotenone isolated from the yam bean were significantly correlated with toxicity. The Meijer color test is proposed as a suitable chemical method for indicating approximately the toxicity of yam bean samples.

Morphological variation, geographical occurrence, and habitat have not been shown to affect the toxicity or composition of the sample. Three species of yam bean not previously studied, *Pachyrrhizus tuberosus* (Lam.) Spreng., *P. strigosus* Clausen, and *P. ahipa* (Wedd) Parodi, are reported as toxic to the larvae of the Mexican bean beetle.—*Journal of Agricultural Research, Vol. 74, No. 2.*

•

California Citrus Circular

The Bureau of Pest Control of the California Fruit Growers' Exchange has issued a seasonal pest control program for central California. The circular gives a report of the work done in the past several months, and a description of the effect of new toxic materials tried in citrus groves. Among the new materials named were hexaethyl tetraphosphate, reported to be effective against aphis and soft scales, as well as citrus red spiders. It was noted that the material had inferior residual characteristics. Hexachloro cyclohexane was found to be effective against cotton boll weevil, and shows promise against aphis. The odor was considered to be objectionable to the point of making it unuseable on citrus growth.

DDD (dichloro - diphenyl - dichloroethane) was described as being "similar to DDT," but "On citrus it has not appeared as good as DDT against most insects." The same was true with the methoxy analogue of DDT, described as being "less effective against many insects."

"K - 1875", Bis(p - chloro - phenoxy) methane, has shown considerable residual effect against citrus red spider, but is not effective against bud mite. A chlorinated hydrocarbon toxicant, marketed variously as "1068" and "Octa-Klor" was described as slow-acting, but showing promise against aphids, ants and grasshoppers.

"Toxaphene," a chlorinated camphene is described as being more effective against some insects than DDT. It was noted, however, that work with the material had been too limited thus far to justify any statement. "889" (di-2-ethylhexyl-phthalate); is a good solvent for many toxicants, and is toxic itself, the circular states. Experimentally, it has been promising against citrus red spider, citrus bud mite, rust mite and aphids.

Considerable attention was paid to heat generated aerosols, which were tentatively considered to "appear more practical than the liquified ones for use on certain crops." The circular states that use of applicators producing "fog" or "smoke" on citrus have been an effort to provide a cheap and fast means of using insecticides effectively. It concludes, however, that experimental use on citrus has indicated the difficulty of obtaining uniform coverage.

•

Mosquito-Fumer Announced

Tobacco By-Products Corp., Louisville, Ky., has announced limited production of its "Black Leaf Mosquito-Fumer." The toxic material, containing 14% DDT and 5% nicotine expressed as alkaloid, produces a "smoke aerosol" effect when ignited. The product is marketed in a tin container in the top of which is a "window" which melts upon contact with a lighter which is part of the package. The contents, thus ignited, form sufficient pressure to expel the toxic materials with smoke. Protection for the person applying the container is provided by a heavy cardboard covering.

•

Purdue Annual Report

The fifty-eighth annual report of the Purdue University Agricultural Experiment Station, Lafayette, Indiana, has recently been issued. The material, presented by director H. J. Reed, covers the year ending June 30, 1945.

In the section on agricultural chemistry, codling moth control and control of the tomato hornworm, are discussed and an extraction study of the rat-killing principle of red squill is presented. It is reported that an estimated 448,894 tons of commercial fertilizers with a retail value of $15,916,283 were sold in Indiana in 1944.

A large portion of the report is devoted to a discussion of entomological findings in relation to resistance of various hybrids to the European corn borer, and data on its infestations in 1943 and '44. Studies were also conducted on control of the Oriental fruit moth which attacks peaches; control of the codling moth, tomato hornworm and other potato and tomato parasites, and on control of cockroaches.

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SOLD BY LEADING MANUFACTURERS OF INSECTICIDES AND EXTERMINATORS SINCE 1932.

CAUTION

Slow killing insect preparations are not sanitary. They make insects sick and vomit — although your eye does not see this, filth will contaminate food.

— Caution — Against Slow Poisoning —

Fumeral Instant Diffusers are recognized from coast to coast by various industries, warehouses, dairy farms, greenhouses, etc., for their outstanding performance and dependability. — Instant action by a proven, sound, safe method to protect human and animal health; to preserve goods, beverages, clothing, etc.

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MANUFACTURERS OF FUMERAL STATIONARY AND PORTABLE POWER SPRAYERS.

Suppliers' Bulletins

U. S. Rubber "Dust-Spray"

U. S. Rubber Company, New York, has announced a new fungicide, "Dust-Spray" for control of tomato fruit rot. The material contains DDT, rotenone, sulfur and "Phygon," giving it both insecticidal and fungicidal properties. It can be used either as a dust or as a water spray. It is said to control black spot, mildew, bitter rot and black rot diseases as well as such insects as aphids, caterpillars, codling moth, and red mites.

Experiments have indicated that tomato plants treated with the new material were free from fruit rot and produced at the rate of 11 tons of fruit per acre, while untreated plants in the same field yielded only 1.2 tons of fruit per acre. The remainder of the crop rotted on the vine before ripening.

•

"Prentox" Products

R. J. Prentiss & Co., New York, announce that they are now offering benzene hexachloride and hexaethyl tetraphosphate. The products will be offered only as concentrates for insecticide formulation and neither material will be offered for consumer use.

"Prentox" benzene hexachloride will be sold as a powder containing 5% of the active gamma isomer, for use in formulating dry or wettable dusts. "Prentox" hexaethyl tetraphosphate will be sold as a 50% solution. The company states that its entomologists will be available to assist in the proper application of these materials, and to coordinate the work of state and federal laboratories and extension service programs with the availability of finished materials.

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F. & B. Pamphlet Out

Faesy & Besthoff, Inc., New York, have prepared an instructive leaflet on their product "Micro Nu-Cop," a fixed neutral insoluble micronized copper fungicide containing 53 percent copper. Included is a spray and dust guide describing proper mixtures for control of various diseases of potatoes, tomatoes, celery, grapes, cabbage, carrots and other vegetables, as well as ornamental shrubbery. The chart also reviews the compatibility of "Micro Nu-Cop" with various insecticidal materials. It is available from the company, 220 E. 42nd St., New York 17.

•

Pennsalt Liquid 2,4-D

Pennsylvania Salt Co., Philadelphia, announces production of a liquid form of 2,4-D, under the trade name of "Knox-Out Weeds Liquid." The new product will be sold in addition to the powdered form of 2,4-D, known as "Knox-Out Weeds." The liquid will be marketed in 8 ounce and pint bottles by the B-K division and Household Products Division of the company. An eight-page color leaflet describing the product is available.

•

Phelps-Dodge Bordeaux

Use of Bordeaux as a control for late blight on tomatoes is thoroughly discussed in an informative booklet issued by Phelps-Dodge Refining Corporation, 40 Wall St., New York 5. The subject matter answers many questions regarding late blight, tells how bordeaux acts to control disease, and gives proper methods of preparing the material.

•

Pulverizing Machine Catalog

Pulverizing Machinery Co. has issued a catalog describing its mikro-atomizer and mikro-pulverizer line for use in reducing raw materials of various descriptions. The 50-page book is thoroughly illustrated in color.

•

Soil Fumigation Booklet

Innis, Speiden & Co., New York, have produced a booklet on soil fumigation with "Larvacide," a chlorpicrin product. General directions for use are given, including charts and graphs on soil condition and eight essential steps in the fumigation process. Application equipment is described at length.

•

BHC Technical Bulletin

John Powell & Co., New York, has published a technical bulletin on benzene hexachloride (BHC). The bulletin gives the history of the material, its chemistry, chemical and physical properties, toxicity, compatibility, insecticidal action, and uses. The bulletin lists numerous insects to which the material is toxic and gives the proper concentration to use.

•

Sprayer-Duster Products

Buffalo Turbine Co., Gowanda, N. Y. has prepared a six-page illustrated folder on its agricultural sprayer and duster line. The brochure describes various types of equipment available and presents a number of photographs to illustrate. The booklet is available from the company.

•

2,4-D Literature

Sherwin-Williams Co., Cleveland, has recently issued a factual mimeographed booklet on its 2, 4-D product, "Weed-No-More." Information regarding home-made gravity spray units, and proper concentrations of the material are contained in the seven pages of copy.

•

Packaging Methods Told

Modern packaging methods are discussed in a "case history" brochure recently published by St. Regis Paper Co., 230 Park Ave., New York 17. The folder describes methods recommended by the bag company, and illustrates many steps in the process.

•

Compressor Line Announced

Sullivan Division of Joy Manufacturing Co., Michigan City, Indiana, announces its new "Unitair" compressor line, featuring machines in nine sizes ranging from 15 to 100 horsepower.

Now...a 2,4-D formulation for killing weeds in small grains!

Baker's 2,4-D Formulation #1

HELPS YOU MEET THIS NEW MARKET

Crop specialists at the recent North Central Weed Control Conference went on record, approving 2,4-D formulations for eliminating weeds in small grains.

On the basis of accumulated data, they recommended 2,4-D formulations for treating fields of wheat, oats, barley and rye when infested with annual weeds—such as the various species of wild mustard.

The best time to treat small grains is when the crop is about 3 inches high... before jointing, or after the milk stage. Current recommendations by the crop specialists are met very economically by the use of Baker's 2, 4-D Formulation #1. All recommendations of these authorities in their report are, of course, subject to change as new data may be produced.

For you who market weed killers, the recognition of this new use for 2,4-D formulations greatly increases the scope of your market. To help you meet this expanding market — the J. T. Baker Chemical Co. can supply you a special formulation of the Sodium Salt of 2,4-D—ask for Formulation #1.

Prices and further information will be gladly sent upon request. Address *Organic Chemical Division*, J. T. Baker Chemical Co., Executive Offices, Phillipsburg, N. J.

Baker's Chemicals

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INDUSTRY NEWS

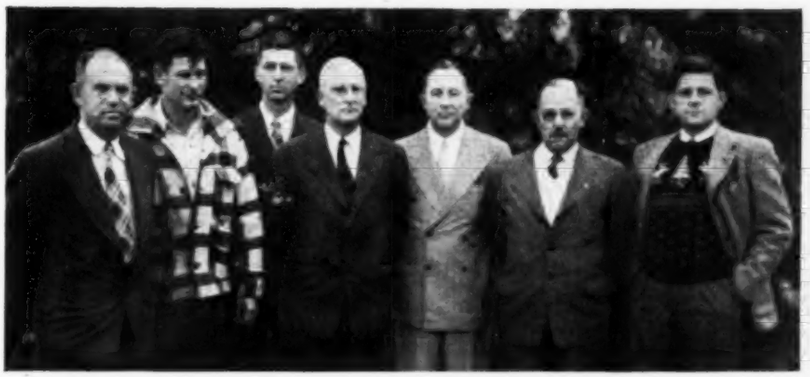
Hearings On H. R. 1237

Congressional hearings on the new proposed federal insecticide law (H.R. 1237) were begun in Washington on April 11. Dr. Harry E. Reed, director of the Livestock Branch, Production and Marketing Administration, U.S.D.A. testified before the subcommittee of the House Agriculture Committee, pointing out how the Andresen bill (H.R. 1237, introduced into Congress January 23, 1947 by Rep. August H. Andresen of Minnesota) parallels the Uniform State Economic Poisons Act, adopted by the Council of State Governments and approved by several States. He stated the bill would promote identical labeling requirements among the states and between the states and the Federal Government.

Mr. Reed proposed a number of amendments to the bill, some of which were opposed by the industry spokesmen. Severest criticism was directed at a proposed amendment requiring a periodic renewal of registration with the Department of Agriculture for all economic poisons. An alternate amendment was suggested, which would require manufacturers to report periodically as to whether their registered products are still on the market.

Opposition was also raised by industry spokesmen to a proposal to include advertising under the labeling provisions of the bill, maintaining that consumers follow printed directions rather than instructions via radio or magazine advertisements.

Two other amendments were suggested, one by Dr. W. N. Watson, secretary of the M.C.A., and the other by John Conner of the N.A.I.D.M. Dr. Watson's suggestion would grant the Secretary of Agriculture authority to determine suitable names for ingredients mentioned on product labels, to cope with lengthy names of various organic chemicals used. Mr. Conner asked imprisonment for violation for the second, and not the first violation of the act. Further hearings on the bill are scheduled.



In an effort to control drift of toxic materials being applied by both ground apparatus and airplanes, the above committee has been organized to make a study of the problem. From left to right: Dr. A. E. Michelbacher, University of California; Bernell Harlan, Woodland vegetable grower; Dr. O. C. French, University of California; W. B. Parker, California Spray Chemical Corporation; Carl Rodergerdts, secretary Airplane Operators' Association; Stewart Lockwood, California State Department of Agriculture; and Dr. W. W. Middlehauf, University of California.

Adopt "Chlordane"

In an effort to end confusion in nomenclature of the chlorinated hydrocarbon insect toxicant marketed by Velsicol Corporation of Chicago, under the name of "1068" and by Julius Hyman & Co., Denver, under the name of "Octa-Klor," the common name "chlordane" has been selected to designate the material. The term is registered with the U.S. Patent office, and is not to be used as a trade name.

Coming Meetings

Agricultural Chemicals wishes to publish the meeting date and place of any gathering concerned with manufacturing, distribution, application or discussion of chemicals for agricultural use. Information of such meetings is solicited for publication.

American Plant Food Council
June 13, 14, 15. Hot Springs, Va.

National Fertilizer Association
June 19, 20, 21. Essex & Sussex Hotel, Spring Lake, N. J.

American Association of Economic Entomologists (Pacific Slope Branch) Last week in June. San Francisco, Calif.

Pacific Chemical Exposition
October 21-25, San Francisco, Calif.

American Association of Economic Entomologists (In conjunction with meeting of American Association for Advancement of Science, December 26-31, Congress Hotel, Chicago, Ill.

Toxaphene Supply Limited

"Toxaphene," insecticide toxicant produced by Hercules Powder Co., Wilmington, Del., will be distributed in 1947 only to U. S. Department of Agriculture field stations, state agricultural field stations, and basic agricultural insecticide manufacturers, the company has announced. The material a chlorinated camphene, has shown promise of being effective against cotton insects, Mexican bean beetles, sugarcane borers, tobacco hornworms, grasshoppers and German cockroaches.

Joins American Cyanamid

Tildon Easley was recently named agriculturalist for the southwestern states, by American Cyanamid Co. He assumed his duties on March 17 at his headquarters, Little Rock, Ark. Mr. Easley has had wide experience in the agronomic field throughout the south, having been a teacher and an agronomist with the Arkansas Agricultural Extension Service.

To Discuss Insecticides

Recent developments in the insecticide field will be discussed during a series of conferences to run concurrently with the Pacific Chemical Exposition in San Francisco, October 21 to 25. The Pacific Insecticide institute will be in charge of this phase of the program, according to Dr. Robert Matteson, chairman of the California section of the American Chemical Society, sponsor of the exposition.

•

New VP For Besler

Timothy E. Colvin was recently elected executive vice-president and director of Besler Corporation, Emeryville, California. Mr. Colvin was formerly president of Aerco Corporation, Los Angeles, and before that was executive vice president in charge of the Burbank Division of Aireon Mfg. Corp.

The coming of Mr. Colvin to Besler Corp. is part of an expansion program in the firm's manufacturing and sales activities involving the "Bes-Kil" aerosol generator as well as the Besler line of steam generators for power and processing.

•

Chase Bag Centennial

Chase Bag Co., Chicago, is currently observing its 100th year in the bag business. The company, which manufactures open mesh bags, multiwall, burlap, cotton bags and other special types, is utilizing an unusual advertising program during the year in observance of the anniversary. The advertisements picture historic events of the past century and connect them with the chronology of Chase's development. The firm has issued a booklet which is available by writing the company, 309 W. Jackson Blvd., Chicago.

•

Chemurgic Meeting in Okla.

The Twelfth Annual National Chemurgic Clinic was held in a four-day session at Oklahoma City March 26-29, under the sponsorship of the National Farm Chemurgic Council. A variety of subjects were scheduled for discussion, including "Research in the Agricultural Chemical Field," "Agricultural Program of the Petroleum Industry," "Prosperity through Research," "Petroleum and Agriculture" and "The Future of Agriculture."

Among the speakers scheduled to be present at the meeting were Wheeler McMillen, president of the National Farm Chemurgic Council; Hon. Val. Peterson, Governor of Nebraska; Hon. Roy J. Turner, Governor of Oklahoma; Howard Huston, American Cyanamid Co.; Eugene Perrin, Dow Chemical Co.; Dr. George L. Cross, president, University of Oklahoma; Dr. M. H. Thornton, Midwest Research Institute; Dr. Roy Hansberry, Shell Oil Co.; George S. Krieger, Ethyl Corp.; Franklyn Waltman, Sun Oil Co.; E. N. Nelson, research chemist, Continental Oil Co.; J. A. Hoban, B. F. Goodrich Co.; Dr. John Leahy, Cotton Research Committee of Texas; L. G. McDowell, Florida Citrus Commission; L. F. Livingston, E. I. duPont de Nemours & Co., Inc.; and Al Lippman, Jr., Bay Chemical Co.

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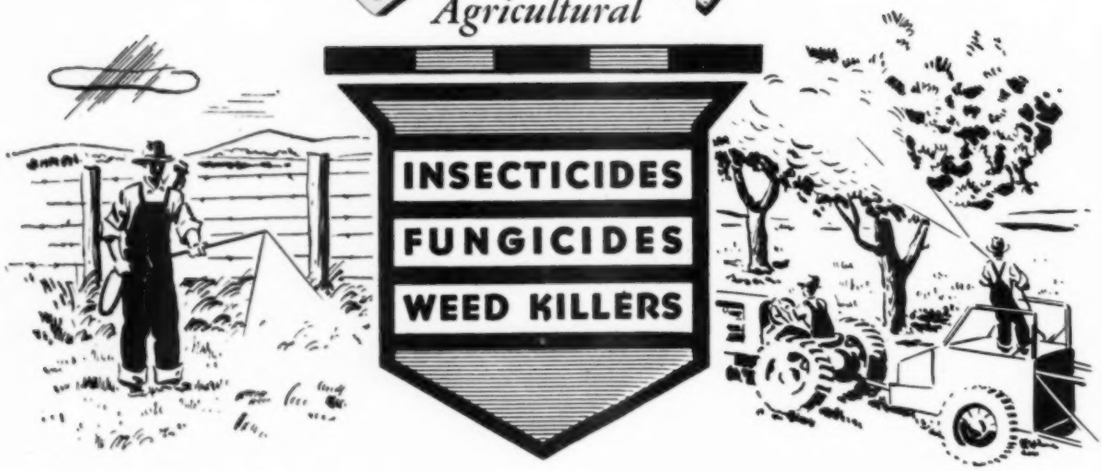

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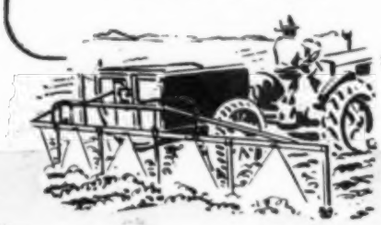

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Ideal stabilized (fixed) copper fungicide. Recommended for copper-controlled diseases of vegetables and fruits—including tomato blight and cherry leaf spot. Used as a dust or spray; combines with various insecticides. Requires no lime when applied on truck crops. Also available in COPPER HYDRO DUSTS... ready-mixed with calcium arsenate, rotenone or sulfur.

P-C-H "20" DUST

New and different non-poisonous insecticide. Contains piperonyl cyclohexenone, a highly toxic chemical. Kills many insects, including Mexican bean beetle, bean leaf hopper, cabbage worms and several species of flea beetles. Combines with other materials for use in mixed dusts. May be obtained ready-mixed with sulfur or Copper Hydro.

CHIPMAN DDT DUSTS & SPRAYS

Chipman DDT 50% Spray Powder: Contains 50% DDT. Kills many insects on truck crops, fruits and livestock. Also used for base in making DDT dusts.

Chipman DDT Dusts: Available in strengths of 3%, 5% and 10% DDT.

Dual Dust: Contains DDT and Copper Hydro. For control of both insects and diseases.

Dual Spray: A wettable spray powder containing DDT and Copper Hydro. For insect and disease control.

Chipman DDT 25% Liquid: Contains 25% DDT. For use as an emulsion spray.

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Opens New Calif. Plant

Opening of its new West Coast plant at Richmond, California is announced by the Niagara Sprayer and Chemical Division of Food Machinery Corporation, San Jose, Calif. The new plant is equipped with modern facilities for the blending, grinding and processing of agricultural dusts and sprays. Manufacturing floor space totals some 35,000 square feet in addition to an office building and research library. Cost of the installation was $500,000 according to the company.

Among operations carried out at the new plant are the fusing of bentonite and sulfur. All grades of sulfur will be ground for agricultural and industrial purposes, the announcement says, and DDT formulation will be carried out along with a variety of dusts and sprays applicable to west coast insect control.

•

Nitrogen Faces Deficit

In a recent statement to the press, M. H. Lockwood, president of the National Fertilizer Association expressed confidence that the industry would make substantial headway toward meeting the 1947-48 agricultural nitrogen requirements of the U. S. and its possessions estimated by the U.S.D.A. at 800,000 to 850,000 tons. The apparent supply this year is approximately 693,00 to 723,000 tons. He stated that industry is ready to convert war-built facilities to effective peace-time use, on a competitive basis. This would mean a stepping-up of production from the war-time pace, and removing from taxpayers the burden of operation.

•

Vermont Growers Meet

Vermont Fruit Growers held a two-day conference April 2 and 3 at Rutland. Speakers included Dean Joseph E. Carrigan of the U. of Vermont College of Agriculture, Dr. Philip Garman, Connecticut Agricultural Experiment Station, Dr. W. D. Mills, and Dr. A. B. Burrell of Cornell University; and E. J. Rasmussen, New Hampshire Extension horticulturalist. Topics discussed included pest control on various fruits, and control of apple diseases.

Collins Joins Amecco

J. G. COLLINS

J. G. Collins, formerly of Naugatuck Chemical Division of U.S. Rubber Co. has been named vice-president and general sales manager of Amecco Chemicals, Inc., New York. The company, offices of which are at 60 East 42nd St., manufactures industrial chemicals.

Mr. Collins is a graduate of Massachusetts Institute of Technology, with a degree in chemical engineering. He joined U. S. Rubber Co., Naugatuck Chemical Division, in 1933 specializing at first in technical sales development until he was appointed sales manager for agricultural chemicals in 1942. Last year he became manager of sales development for special chemicals.

•

D & O Elects Officers

F. T. Dodge was elected chairman of the board of directors of Dodge and Olcott, Inc., and F. T. Myers was named president of the firm at a recent meeting of the company's board of directors.

Mr. Dodge has been with the firm since 1904, and president since 1926. His first official position was in 1918 when he became treasurer of the company. In addition to his affiliation with D & O, Mr. Dodge is also director of U. S. Industrial Chemicals, Inc., the parent company of Dodge & Olcott, Inc.

Mr. Myers began his career with Dodge and Olcott 40 years ago and subsequently advanced to general managership of the Bayonne (N. J.) plant, and thence to a directorship in the company. He later became a vice-president, and then executive vice-president of Dodge and Olcott, Inc. He served in the U. S. Navy during World War I.

American Equipment Goes Abroad

Modern spray dusting invades the Netherlands. View of a Buffalo Turbine spray duster operating near Hillegom, Holland. Note windmill in background. Apparently the realization is spreading in Europe that modern chemicals and modern application methods are two of the answers to the European food problem. Photo courtesy of Buffalo Turbine Agricultural Equipment Co., Gowanda, N. Y.

N. Y. Flower Show

The annual International Flower Show held in New York City in March offered an opportunity for many firms to present their products to thousands of persons attending the show. Among the exhibitors in the field of chemicals for agriculture were American Chemical Paint Co., Ambler, Pa., weed killers; American Agricultural Chemical Co., New York; J. J. Parker Mfg. Co., Bronx, N. Y., chemical supplies; Goulard & Olena, Inc., Skillman, N. J., fertilizers and insecticides; Gerald S. Russell Co., Long Island City, N. Y., insecticides and weed killers; Hydroponic Chemical Co., New York, chemicals; Ferry Morse Seed Co., Detroit; Julius Roehrs Co., Nursery, Rutherford, N. J.; Agricultural Laboratories, Columbus, Ohio; O. E. Linck Co., Inc., insecticides, Clifton, N. J.; Andrew Wilson Co., insecticides and fungicides, Springfield, N. J.; Aeroil Products Co., West New York, N. J.; Doggett Pfeil Co., Springfield, N. J., chemicals; Dow Chemical Co., Midland, Mich., insecticides, weed killers; Lohrman Seed Co., Detroit, Mich.; and Premier Peat Moss Corp., New York, fertilizer.

The 1947 Flower Show was said to have attracted the largest attendance in many years. Booth attendants at the show indicated a record demand for information regarding new products in the fields of insecticides, fungicides, weed killers, fertilizers and application equipment.

•

New Pennsalt Products

Pennsylvania Salt Manufacturing Co. Philadelphia, has added two of its DDT products to the "Knox-Out" line of insecticides and weed killers marketed by the company. The two additions are the former "Pennsalt DDT Emulsion Concentrate" and "Pensalco Livestock and Barn Spray." The former becomes "Knox-Out Emulsion Concentrate," and the latter "Knox-Out Stock and Barn Spray."

The emulsion concentrate is a surface residual spray containing 34% DDT. The stock and barn spray is a micronized wettable dust containing 50% DDT.

Experimental Laboratory Opened by Geigy Co.

Geigy Co., Inc., has formally opened a new laboratory (above) on a site adjoining its plant in Bayonne, N. J. The new facilities afford close collaboration between the technical staff of the American Division of the company with the parent firm, J. R. Geigy, S. A., Basle, Switzerland. In charge of the Bayonne laboratory is Dr. George R. Ferguson, chief entomologist. As a specialist, C. C. Alexander administers the laboratory and field work on fruit insects, and E. L. Bailes is in charge of the chemical work. The laboratory is being used for extensive research particularly in the field of insecticides. The building is air-conditioned to provide proper atmosphere for all types of spray, dust, and aerosol experiments.

New Plant to Produce Benzene Hexachloride

Terre Haute, Indiana, is the location of this new insecticide plant now under construction by Commercial Solvents Corporation of New York. Upon completion of the plant, mass production of benzene hexachloride will begin, according to the company. The product will be marketed by Commercial Solvents Corp. under the trade name of "Sixide." Production is expected to be under way late in the spring.

Swift & Co. Opens Florida Fertilizer Plant

Limited operations in the manufacture of plant food and insecticides are now under way at this new Swift & Company plant food factory at Winter Haven, Fla. The new factory, when completed, will complement the Swift phosphate rock mine at Bartlow, Florida, to supply chemical fertilizer to central and southern Florida citrus growers. Capacity is expected to be 30,000 tons annually. At the left of the factory is the air-conditioned office.

Livestock Report Issued

The annual report of the National Livestock Loss Prevention Board, southwestern region, has been issued by Ray L. Cuff, regional manager. The book is a comprehensive portrayal of the work done by the board during 1946, and includes reprinted articles from various magazines which have described the program of the NLLPB. Among these is a reprint of an article from the October, 1946 issue of AGRICULTURAL CHEMICALS, which featured the DDT cattle spray program in Kansas and Oklahoma. Descriptions of cattle spray problems are included, together with a tabulation of results computed in a graphic manner. A report of numerous radio programs sponsored by the group is given, as well as plans for future broadcasts.

•

Bee Keepers Ask DDT Use

At the request of the Northeast Arkansas Beekeepers Association, several cotton farmers in that section will experiment this year in pest control with DDT which is virtually harmless to bees, in contrast with heavy damage from arsenic poisons. In collecting pollen, State Apiary Inspector J. H. Davis, Little Rock, is reported as having said that bees also collect the grains of arsenic which cause deaths of young bees in the hives. Although DDT may result in the death of an adult bee at the plant, it will not be taken into the hive. DDT has been found effective against the three worst pests of the cotton field—the boll weevil, army worm, and cotton hopper—but arsenic is not effective against the hopper according to Inspector Davis. Although DDT can be sprayed from a plane it will not remain on the plant as long as arsenic and will destroy all pests quickly, said Inspector Davis.

•

British Group Visits U. S.

Four representatives of the Fertilizer Manufacturers' Association of Great Britain, visiting in the United States were guests at a luncheon in New York March 31. The four, D. J. Bird, president of the association, A. T. Vernon, vice-president; E. P. Hudson, council member; and A. E. Sell of the Imperial Chemical Industries, Ltd., were introduced to a group of American fertilizer suppliers and manufacturers as well as representatives of the press at the meeting. Maurice H. Lockwood, president of the National Fertilizer Association presented the visitors.

•

Michemco Corp. Formed

Formation of a new chemical manufacturing company, a subsidiary of Michigan Chemical Corporation of St. Louis, Mich., has been announced. The new company, Michemco Corp., Inc., located at Pine Bluff, Arkansas, will manufacture a line of industrial and insecticidal chemicals, chiefly chlorinated products.

Officers of the new company are T. C. Davis, president; John L. Giles, vice-president; L. W. Munchmeyer, vice-president; Clarence G. Woods, secretary-treasurer. The first three named are also directors of the company. Physical properties of the plant include part of the facilities of the former Pine Bluff Arsenal now being adapted for its new use. Production is expected to begin in May.

Booklet by Besler

Besler Corporation, Emeryville, California, has published a colored booklet describing the firm's "Bes-Kil" aerosol generator for pest control. The booklet presents a number of views of the machine in action, and gives detailed instruction as to its use in agricultural pest control.

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Sprout-Waldron Catalog

Bulletin I-846, issued by Sprout-Waldron & Co., Muncy, Pa., describes its dust blending machines, and explains how dusts may be prepared for insecticidal use through proper mechanical means. Numerous photographs of machines and sections of various parts are included in the booklet, as well as diagrams and layout plans for installation.

•

Bickerton to Walker Co.

Dr. J. M. Bickerton, for the past six years assistant manager and director of research of the insecticide division of Innis, Speiden & Co., New York, has recently joined the technical sales staff of the Walker Fertilizer Company of Orlando, Fla.

FERTILIZER

Continued from Page 39)

right kind of plant food as well as keeping abreast of technical developments. Much effort has been made to improve the physical condition of fertilizer materials and mixtures. Granulation has added to the cost of production, but the farmers can more economically use material in good mechanical condition. It will be increasingly important to consider the problems of fertilizer manufacture, distribution, price, and conservation a few years hence. It is quite possible that through shifts in the exact specifications of the fertilizers needed within the next decade, the industry will have to make some changes in its method of operations.

Minor plant food elements have received some consideration by fertilizer mixers, but in the future a great deal more attention must be given to this need. Progress has been made in the production of higher analysis mixtures by increasing the supply and use of high analysis materials.

In California, the advanced use of plant food nutrient solutions presents additional problems to be considered. The use of nitrogen and phosphoric acid in irrigation waters has not come into such general use in other parts of the country.

To summarize, industry can carry out its responsibility to the farmer in a number of ways. It can support an extensive research program by lending aid to Federal and State institutions, now doing good work with limited means. Although the industry favors sound research and promotion programs by the Government, it also feels that Government ownership and operation of fertilizer plants will not be to the advantage of the farmer.

The industry's long-time in-

terest will be served by making available to the farmer fertilizer which will bring the best returns from his investment. This effort should be continued, along with cooperation with farmers, Federal and State experimental stations, control agencies, and the Bureau of Plant Industry, Soils and Agricultural Engineering.

GUEST EDITORIAL

(*Continued from Page 20*)

wants to produce and do it efficiently, but if this is to be done there are other objectives which must also be met.

(2) *The widest possible market:* American consumers need more and better food and clothing, and at the same time there is need for maintaining a sizable foreign market for such commodities as cotton, wheat, tobacco and citrus fruit.

(3) *Soil conservation:* New and better methods of procedure are constantly being developed, but it is obvious that crops cannot be produced on soil that "isn't there." Accelerated soil erosion must be stopped.

(4) *Fair prices and equal opportunities:* It is possible to argue endlessly around this objective. Yet if agriculture is to produce, if domestic and foreign needs are to be met and soil erosion controlled, agriculture is certainly entitled to a fair reward.

However, an agricultural program cannot be built around any one objective alone, and the eventual success or failure of even the best designed program depends upon industry as well as consumers. After all, a prosperous agriculture cannot be maintained unless nonfarm employment, payrolls and the flow of industrial goods and services are also held at a high level.

RAW MATERIALS

(*Continued from Page 51*)

the first seven months of the current fertilizer year was 4,771,438 tons, compared with 3,771,398 tons for the corresponding period of 1945-46. This was an increase of 27 percent.

Transportation troubles continue to beset the industry despite the recent governmental directive rescinding a former order for the fertliizer industry to return to the army 300 tankcars which had been leased. Industry spokesmen indicated that at least up to the latter part of March, the army was still requisitioning tank cars from the industry.

A Congressional Subcommittee of the Committee on Agriculture, has recommended that future Army exports to occupied countries be limited to production from army-operated plants, and a review made of other Government commitment. The Sub-committee also stated that nitrogenous material borrowed by the War Department should be repaid immediately and made available to American markets.

Further in the nitgogen field, December imports of Chilean nitrate were very low, 1,486 tons. In fact,

the total for the first 6 months of the 1946-47 fertilizer year was about half the tonnage of the previous year. (117,503 tons compared with 203,179 tons.) Various strikes have resulted in a slowing of imports, but the U. S. Maritime Commission has assigned 15 ships to bring in the remaining 480,000 tons of this year's quota by June. The over-all picture, however, is one of shortage, since estimated world requirements of nitrogen are 35 percent beyond the probable output of 2,555,000 tons.

Normal superphosphates enjoyed a record output in December, with a production figure of 709,122 tons. This was 6 percent above the preceding month, and 20 percent above December of 1945. Production of concentrated superphosphate dropped 11 percent in December.

During the first half of the 1946-47 fertilizer year, production totaled 3,915,213 tons of normal superphosphate, 171,439 tons of concentrated superphosphate and 21,306 tons of wet base goods. Reduced to 100 percent P_2O_5 basis, total output would be equivalent to 785,367 tons as compared with 741,442 tons during the corresponding period of the previous year.

According to the American Potash Institute, deliveries of the material by the 5 major American producers were slightly above the same period last year. (216,074 tons compared with 203,995 tons). It was also noted that agricultural use of the K_2O was 8 percent higher than the previous year.

Importation of 16,000 tons of potash from France was scheduled to arrive in the U. S. during March, April and May. A total of 11,000 tons was to come during the first two months, and a shipment of 5,000 tons is scheduled for May. Despite these importations, supplies of potash are short of requirements. Allocation of potash was ended on February 17 in accordance with the general policy of removing controls. However, allocations which have made through March 31 will not be affected by the revocation since the undelivered portion of the quota is all under contract.

COX COMMENTS

(*Continued from Page 49*)

soils where root crops soon are to be planted. Dusts have shown some injury to cucurbits in moist weather. Dr. Harry Lange stated that treatment of lima bean seeds appeared to protect them from garden centipedes.

We should be prepared to accept more and more new and promising synthetic organic economic poison products. Every new product lacks an historical background, but through such meetings as these real progress is made. It is unlikely that any new materials will displace those established, but there will be a greater number of materials with which to control pests.

INSECTICIDE DILUENT

(*Continued from Page 43*)

as a contact poison but may still be useful as a stomach poison. Diluents ordinarily considered inert can exhibit noticeable surface absorption in extremely small particles, so that it may be incorrect to consider them completely inert under all conditions.

The decomposition of DDT by the anhydrous chlorides and oxides of iron, chromium, and aluminum [5] is an example of chemical activity of diluents which act as catalysts. Another type of chemical effect which diluents may have is activity due to acidity or alkalinity such as calcium carbonate on hydrated lime reacting with nicotine sulfate to form free nicotine. For such reasons, these materials are called "active" diluents. These diluents are useful even in this particular case involving nicotine, if a quick-acting contact insecticidal dust is desired. In many cases, however, there is no activity between so-called "active" diluents and the insecticidal agent.

Using Fleck and Haller's technique [5] for testing DDT diluents for chemical reactivity, it was found that DDT is not affected by "Dilroc" under the conditions of their test. It was decided that a storage test should be run on a DDT-"Dilroc" mixture to determine if the mixture lost its effectiveness or caked on storage. Accordingly, a 10% DDT-"Dilroc" sample was prepared and stored in the laboratory for one year. On recent examination this mixture showed no evidence of caking having occurred during storage. The one year old 10% DDT-"Dilroc" sample was com-

5 Fleck and Haller, "Compatability of DDT with Insecticides, Fungicides and Fertilizers," *Ind. & Eng. Chem. 37*, p 403, 1945.

pared with newly prepared 10% DDT-"Dilroc" and 10% DDT-clay dust samples as to effectiveness in knocking down houseflies. A surface contact test was used to evaluate the three dust samples by determining the time for "50 percent knock down" of houseflies. The method used was to spread 0.2 gram of each dust uniformly over 80 sq. in. of cardboard and to make this cardboard the bottom of a very shallow glass covered tray which is then filled with houseflies. The time for 50 percent of the houseflies to be knocked down was determined for each dust. No difference was found between the new "Dilroc," year old "Dilroc," or new clay 10% DDT dusts—all three required 11 minutes exposure to knock down 50 percent of the houseflies.

In conclusion, Florida limerock may be finely ground to produce a powdered material suitable for use as an insecticide diluent. Using a laboratory hammer mill and air separator, a material having a surface mean particle diameter of 2.8 microns has been produced. This diluent material, named "Dilroc," has about the same particle size and oil absorption values as other common diluents but its bulk density value is greater than ordinary diluents.

It has been shown that mixtures of 10% DDT-"Dilroc" are stable, do not cake on storage, can be dusted in ordinary hand dusters, and are effective against houseflies. "Dilroc" does not react with DDT using the Fleck and Haller compatability test.★★

WEED CONTROL

(*Continued from Page* 29)

Summary of Advantages

BEFORE the development of 2,4-D herbicides it was not possible to destroy many common weeds without at least serious damage to desirable vegetation. It is this selective action that has made possible the general acceptance of this new weed killing agent and which accounts for the enormous demand.

Exhaustive tests indicate that 2,4-D is non-poisonous, that the residue remaining on sprayed vegetation is harmless to livestock and that the spray mist is non-irritating to those applying it.

Compounds of 2,4-D when properly prepared are non-corrosive to spray equipment and do not cause deterioration of rubber hose. Neither are they inflammable, nor do they increase the fire hazard of vegetation which is destroyed.

Soil is not rendered sterile through the use of this weed killer. Unlike certain inorganic compounds, 2,4-D decomposes within a period of a few months in moist soil, and no toxic residue remains to prevent further use of the ground.

Only a minute quantity of 2,4-D is required for weed control, less than ½ gallon of a 40% compound being sufficient to prepare enough spray to cover an entire acre. The cost of treating an average lawn should not exceed 50c for material, and field treatment can be accomplished for $4.00 to $5.00 per acre.

Many herbicides destroy only surface growth and the roots remain to send up new foliage. The slow

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Simply mix with water and apply it with spray or brush. It covers metal, wood, stone, cement or cinder block—will not chip or flake off—contains no lime.

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action of 2,4-D allows the plant to transport the material throughout its entire system so that many weeds are completely destroyed.

New 2,4-D Developments

ATTEMPTS to improve present 2,4-D preparations and their methods of application are continuing. One promising possibility is the application of 2,4-D in a dry form along with fertilizer materials (4). This would do much to prevent the drifting of the weed killer onto desirable vegetation. A study is also being made of the possibility of combining 2,4-D with other agents which will enable it to destroy Johnson grass and other grasses. For large scale applications where damage to desirable vegetation is not a problem, airplane dusting of dry 2,4-D compounds is being tested.

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FUMIGATION

(*Continued from Page 23*)

insects at low temperatures, with the tendency for less satisfactory insect destruction below these temperatures

Closely related to temperature is humidity, also an important factor affecting fumigation. With suitable temperatures, fumigation may proceed with increasing humidity up to the point where actual moisture in the form of dew becomes apparent on the leaves of the trees. At that point the work should be discontinued. The danger of fumigation injury is much increased when the trees and tents become damp largely because of the greater tightness of the tents and consequently the smaller gas leakage rate, thus subjecting the trees to higher average gas concentrations.

On the other hand with low relative humidities, it has been found advisable to refrain from fumigation work when the humidity limit is excessively low. While no definite figure for the low humidity limit has been set officially, most fumigators hesitate to start work when the humidity is below 25%.

Fumigation should never be attempted while there is much wind blowing. One reason for this is obvious. The air movement causes an abnormally high leakage rate of gas from the tent. It also causes uneven gas distribution within the tent. This may do two things, cause injury in some portions of the tree and give irregular and unsatisfactory insect destruction. The usual rule by which fumigators work is to discontinue or refrain from operation when there is breeze enough to cause appreciable movement or flapping of the tents.

Soil moisture is a factor of importance in the summer season, but of very little significance in the winter. It has been found that there is somewhat more danger of fumigation injury when the soil is wet in summer than when it is fairly dry. Hence, fumigation is generally timed to take place within a week or ten days preceding a regular irrigation, and not immediately following. In the winter season with frequent rains, the soil condition is considered only in avoiding mud. In other words, during the winter fumigation may be conducted at any time when the soil is dry enough to permit the crew to work conveniently. In an orchard with a sandy type soil, fumigation might proceed in the winter within a day or two following a heavy rain.

Cover crops or weeds in an orchard need to be considered for two reasons, when planning fumigation. First with heavy growth of cover crop it is very difficult to make the tents lie flat against the ground. Thus there is occasion for rapid leakage of gas under the tent, decreasing the mean gas concentration for the time of exposure and consequently reducing the insect kill. Also the cover crop has a tendency to absorb and condense the gas, thus rendering the concentration within the tree uneven and low. This is especially true where the atomizer type of applicator is used. Cover crops are still more unfavorable for the use of "Cyanogas." While it is not always convenient to do all fumigation work while the orchard is cleanly cultivated, that is certainly the most suitable condition. For late winter work when there is generally no orchard cultivation and the weeds or cover crops have developed, it is advisable to mow the growth under and around the trees. In all cases, the successful destruction of the insect pests is of primary importance and the conditions for the fumigation should be selected or modified so as to be at the optimum for this purpose . . . . although the safety of the trees must always be considered.

The use of Bordeaux mixture in spraying citrus trees for certain fungus diseases complicates the fumigation program. It is especially dangerous to fumigate trees which have been sprayed with Bordeaux within the preceding six months, for

such trees may suffer severe injury. Fumigation injury due to Bordeaux takes the form of severe leaf burning and defoliation and pitting of the fruit. Where it is known that Bordeaux must be applied, fumigation should be done ahead of the spray application if possible. If not, the fumigation should be postponed at least six months. While there is considerable variation in the possible injury from fumigation following a Bordeaux application, the danger of such injury is so great that only emergency conditions would justify such a procedure.

The season of the year when fumigation should be done depends upon several factors such as tree condition, size of fruit and especially important, the kind of insect and its life history. When the fruit is too small it is subject to HCN injury, particularly oranges. The fruit should preferably be the size of walnuts or larger. Grapefruit is quite similar to oranges. Lemons are much less susceptible to injury than oranges or grapefruit and young lemons are not usually injured. The tree condition should be such that it can withstand the fumigation without danger of injury. During the late spring and early summer, the orange and grapefruit trees undergo an unusually active period and are especially sensitive during that time. Aside from two or three months at that time, fumigation may be carried on at any time during the year. In some localities there is another active period in October, but this is less pronounced.

Since there are several types of scale insects infesting citrus trees, fumigation must be timed for each one of them to take advantage of the period in the life history of the insect when the gas may be most effective. Naturally the timing of the fumigation will be at different seasons for various scale insects. The black and citricola scales normally produce one generation per year, hence fumigation for them is best timed to take place during the summer when the new brood is hatched and while the insects are young and much more easily killed than they would be in the more mature stages.

Red Scale

CALIFORNIA red scale, *Aonidiella aurantii,* has been the subject of much intense study and experimentation. This has come about because of the rapid spreading of the insect and the serious damage caused when its population is allowed to build up. No other citrus scale in California can so quickly and permanently injure the tree. It infests all parts of the tree including the leaves, fruit branches and trunk. Branches of considerable size are frequently severely injured in a single season's infestation. There may be heavy defoliation. Badly infested fruits are unmarketable. The injury is all occasioned by the feeding of the insects, since they do not excrete honey dew like the black and citricola scales.

The red scale does not lay eggs but what ordinarily corresponds to the egg hatches within the body of the parent. The larva remains under the shell of the parent scale for a day or two after birth, then emerges. The

young do not as a rule migrate very far from their parent scale; usually crawling not over two feet in any direction. They may settle on the leaves, branches or fruit. Once settled, the females remain there the rest of their existence. The males also remain until the winged adults emerge from the scale covering.

As soon as it has settled, the young scale begins the secretion of a covering which is enlarged as the insect develops to take care of the larger body. It undergoes two molts and reaches the final adult stage or young producing stage on the average of 75 to 90 days after settling. This period is shortened about half in summer and about doubled in winter. Thus there are from three to five generations per year. One female may produce 150 or more young. These average about an equal percentage of males and females.

While the young red scale do not crawl any great distance before settling, they are distributed over long distances by other agencies such as wind, birds, insects and by man himself in his usual cultural and fruit harvesting operations. This spread and distribution occurs only while the scale is in the "crawler" stage, but this stage may occur at all seasons except during the colder weather of winter.

Experience in California has shown that, when orchard conditions and weather permit, late winter and spring is the preferred time for fumigation of the red scale. The highest percentage of kill is obtained at that season. This is due, at least in part, to the fact that the scale have been dormant during the preceding months and have not resumed development nor the production of young. While fumigation may be carried out at any time from July to March, or up to the time of blooming, in cases of heavy infestations it is advisable to fumigate without too much delay and thus prevent the accumulated injury to the trees and the further building up of the scale population.

Fumigation properly timed and carried out is the most satisfactory treatment for red scale. In Ventura County, California, a protective league exists for the benefit of the growers through which double fumigation is conducted in each orchard where red scale is found. The purpose of this league is to practically free the area from this pest. The plan has been such a success that but few orchards have even very light red scale infestations and eradication of the pest has evidently been accomplished in some orchards where light infestations were discovered and promptly treated. When an infestation becomes severe and widespread, then eradication becomes practically impossible. This is the condition now prevalent in most of the citrus areas of the world and the most that can be undertaken economically and within practical limits is to keep the population of scale under control so that damage to trees and fruit may remain at a minimum. This is accomplished most successfully by fumigation with hydrocyanic acid.★★

Industry Patents

The following patents have recently been issued by the U.S. Patent Office on products and devices in the agricultural chemical field. Copies of the patents may be obtained at 25c each by addressing the U.S. Patent Office, Washington 25, D.C.

2,415,705. PROCESS FOR PRODUCING FERTILIZERS CONTAINING INSOLUBLE NITROGEN. Patent issued February 11, 1947, to Leonard V. Rohner, Syracuse, and Alvin P. Wood, Geddes, N. Y., assignors to the Solvay Process Co., New York. The process for the production of a fertilizer containing active and available insoluble nitrogen which comprises boiling a pool of aqueous slurry of urea-formaldehyde resin under reduced pressure at a temperature in the range of 40° C. to 75° C., maintaining said slurry acidic and at a pH of 3 to 5, continuously introducing into the boiling slurry formaldehyde and urea in the proportions of 0.75 to 1.25 mols formaldehyde for every 1 mol of urea, whereby said urea and formaldehyde react in said aqueous slurry to form an insoluble resin which is precipitated, continuously removing precipitated resin from said pool, washing the resin until it is substantially freed of acid and then drying the resin while heating it to temperatures low enough to prevent the activity of the insoluble nitrogen of the resin by the neutral $KMnO_4$ test being reduced to below 80%.

2,415,946. METHODS OF MAKING BORON. Patent issued Feb. 18, 1947, to Worth C. Goss, Seattle, Wash. The method of making powdered elemental boron comprising introducing gaseous boron chloride and hydrogen into an electric furnace into a gaseous suspension of powdered boron previously formed, reducing the boron chloride while maintaining the temperature below the melting point of boron, and agitating the previously formed boron to produce powdered elemental boron and recovering the boron.

2,416,004. INSECT CONTROL. Patent issued February 18 to Walter E. Hall, Wood River, Ill., assignor to Shell Development Co., San Francisco, Calif. An insect control composition comprising a predominant amount of mineral spirits and containing from 1% to 25% unsaturated aliphatic nitrile having from 16 to 20 atoms.

2,416,522. N-ALKYLBENZAMIDE AND PYRETHRUM INSECTICIDES. Patent issued February 25, 1947, to S. I. Gertler and H. L. J. Haller, Washington, D. C., assignors to the U. S. of America. A method of destroying insects comprising contacting the insects with an insecticidal composition containing a compound selected from the group consisting of N-butylbenzamide, N, N-di-isobutylbenzamide, and an extract of pyrethrum flowers.

2,416,663. PROCESS OF PRODUCING SULFUR AND FERTILIZERS. Patent issued February 25, 1947, to A. B. Menefee, Cumberstone, Md., and H. C. Greger, Washington, D. C. A method of treating sulfur ores, containing free sulfur, to recover a purified sulfur and fertilizer materials which comprises treating the ore to produce a dewatered flotation concentrate thereof, heating to the melting point of sulfur and agitating the concentrate in the presence of insoluble phosphates and a sufficient amount of sulphuric acid to solubilize at least a portion of the phosphate and to agglomerate the phosphate and gangue of the ore into firm, self- sustaining spheroidal agglomerates of from approximately 1/64 inch in diameter, treating the resultant mass to separate liquid purified sulfur and modulated material having avoidable fertilizing value.

2,416,719. SPRAY GUN. Patent issued March 4, 1947, to H. C. Stockdale, Ravenna, Ohio, assignor to Food Machinery Corp., San Jose, Calif. Gun consists of a stationary barrel, a stationary nozzle on the end of the barrel, two grip means on the gun, located conveniently with reference one to the other so that the gun may be supported and manipulated in directing the spray by gripping one of the grip means in the right hand and the other in the left hand.

2,417,115. IMMUNIZING OF SEED FROM PEST ATTACK. Patent issued March 11, 1947, to Owen B. Lean, Windsor, and P. W. Brian, Wokingham, England, assignors to Imperial Chemical Industries, Ltd. A bird repellent comprising finely divided sulfur nitride and finely divided imino sulfur in admixture with an inert powder.

Trade Mark Applications

SYNDEET, in Stymie bold face capital letters, for insecticides. Filed April 24, 1946, by U. S. Rubber Co., New York. Claims use since Mar. 7, 1946.

MITROL, in ultra Bodoni capital letters, for insecticide. Filed June 24, 1946, by Thomas H. Donahue, doing business as Donahue Mfg. Co., Los Angeles, Calif. Claims use since Feb. 25, 1946.

FREON-23, in gothic capital letters, for trifluoromethane or fluoroform, being fluorinated hydrocarbons used as refrigerants, and propellants. Filed Sept. 19, 1946, by Kinetic Chemicals, Inc., Wilmington, Del. Claims use since Dec. 13, 1945.

ORTHOCIDE, in gothic capital letters, for parasiticides, namely insecticides, fungicides, germicides, and herbicides. Filed April 16, 1946, by California Spray-Chemical Corp., Wilmington, Del. Claims use since Mar. 22, 1946.

ORTHO-PET, same as above.

ORTHO-ROACH, same as above.

ORTHO-TOX, same as above.

DU-AL-CIDE, in tall capital letters, for fungicides, insecticide and germicide. Filed May 21, 1946, by Imperial Chemical Co., Shenandoah, Ia. Claims use since Dec. 31, 1945.

VAPOCOP, in capital letters, for parasiticides. Filed June 28, 1946, by California Spray-Chemical Corp., Richmond, Calif. Claims use since Aug 11, 1941.

VAPOSUL, in capital letters, for parasiticides. Filed June 28, 1946, by California Spray-Chemical Corp., Richmond, Calif. Claims use since July 31, 1941.

VAPOTONE, in capital letters, for parasiticides. Filed June 28, 1946, by California Spray-Chemical Corp., Richmond, Calif. Claims use since May 24, 1946, and in hyphenated form since Aug. 21, 1941.

BUX, in heavy capital letters, for herbicides. Filed July 5, 1946, by California Spray-Chemical Corp., Richmond, Calif. Claims use since June 13, 1946.

D-TER, the "D" in lower case, and "T" a capital letter, for insect repellent in liquid forms for use as a spray or by direct application to the affected area. Filed May 25, 1946, by Chandler Chemical Corp., New York. Claims use since May 14, 1946.

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Trade Marks Granted

427,737. PLANT FOOD. Filed May 31, 1946 by McCormick & Co., Inc., Baltimore, Md.

428,121. INSECTICIDES. Filed Feb. 16, 1946, by E. W. Health III, doing business as Health Products Co., Bristol, Pa.

428,127. INSECTICIDES. Filed Feb. 27, 1946, by Francis H. Hoge, Jr., doing business as the U. N. Products Co. New York.

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N. J. Mosquito Meeting Held

The thirty-fourth annual meet- of the New Jersey Mosquito Extermination Association was held April 2, 3 and 4 at Atlantic City, N. J. Members of the New Jersey Agricultural Experiment Station, representatives of various boards of health, and entomologists from other states presented papers which compared various toxic materials for mosquito control. Charts showing incidence of malaria in the state indicated a favorable curve to offer evidence of progress in mosquito control.

Aside from the technological phase of the meeting, an outdoor demonstration of application machinery was made. A wide variety of sprayers, fog machines, and an airplane sprayer performed before the group. A fresh wind of almost gale proportions failed to interrupt the program.

Commercial exhibits were shown by a number of firms. Among these were the Accurate Tool Co., Newark, N. J., sprayer; Todd Shipyards Corp., New York, insecticide fog applicator; Buffalo Turbine & Blower Co., Townawanda, N. Y., sprayer; Besler Corp., Emeryville, Calif., fog generator; H. D. Hudson Mfg. Co., Chicago, sprayers; Hardie Mfg. Co., Hudson, Mich., sprayers, Tobacco By-Products and Chemical Corp., Louisville, Ky., insecticides; Geigy Co., New York, insecticides; Rohm & Haas Co. ,Philadelphia, insecticides; Smith Tractor & Equipment Co., Union, N. J.,; Microsol Corp., New Haven, Conn., insecticide applicator; F. E. Myers & Bro. Co., Ashland, Ohio, sprayers; Socony Vacuum Oil Co., New York, oil bases; Homelite Corporation, mosquito traps; and two custom airplane sprayers, Tyler Flight Service, Massapequa, L. I., N. Y.; and Lehava Air Service, Philadelphia. In addition, displays were set up by the N. J. Mosquito Extermination Association, California Mosquito Districts, Emerson Yorke Photo studios, and the U. S. Public Health Service.

Classified Advertising

Rates for classified advertisements are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. Address all replies to Classified Advertisements with Box Number, care of AGRICULTURAL CHEMICALS, 254 W. 31st St., New York 1. Closing date: 1st of month.

Wanted: Manufacturing organization desires to purchase small or medium size chemical manufacturing business, including plant, equipment, etc. for cash. Must be actual maker of basic chemical or chemicals, not merely mixing or minor processing. Chemicals with agricultural applications preferred, but will consider others. Buyer has highest standing in industry. Give details in confidence to Box 151 care of *Agricultural Chemicals.*

Filter Press for Sale: Shriver, frame 30" square, side feed open delivery, cast iron washing type press having 20 chambers—flush plate and frame pattern with 2" thick frames. Press equipped with thrust block quick opening arrangement and ratchet closing device. Address Box 152 care of *Agricultural Chemicals.*

Wanted: Salesmen with experience preferably selling raw materials to paint, varnish, insecticide and other manufacturing industries, in eastern and middlewest areas. Also chemical education preferred. Good opportunity with young growing corporation. Address Box 153 care of *Agricultural Chemicals.*

Entomologist Wanted: By large midwest manufacturer for insecticide development and service work. Bachelor degree minimum requirement. Major and some experience in control of insects affecting man and domestic animals preferred. Give age, education, experience, salary desired, availability. Address Box 154 care of *Agricultural Chemicals.*

Sales Position Wanted: Young man eager to represent expanding firm in Northern California selling agricultural chemicals. Qualifications: B.S. in chemistry, graduate work in soils, weed control, and plant pathology. Pleasing personality and lots of ambition. Address Box 155 care of *Agricultural Chemicals.*

DDT-Thanite Spray: Large gallonage in 5 gal. 1CC steel drums suitable for export, institution or industrial resale, 2½% Thanite, 1% DDT in deodorized oil. Grade AA spray. Priced 35-38c gal. FOB Philadelphia. Minimum quantity sale 1000 gals. Cook Industries, 189-A Schaeffer St., Brooklyn 7, N. Y.

Exceptional Buy: Chemical transport Mack truck, mechanically excellent—original cost $7,000. Will sell to quick buyer $1,975. Alleghany Motors, 68 East Blackwell Street, Dover, New Jersey.

Advertisers' Index

(The Advertisers' Index has been carefully checked but no responsibility can be assumed for any omission.)

Tale Ends

FIELD testing of "Toxaphene," new synthetic insecticide of Hercules Powder Co., is reported to indicate an important field for the new product for insect control on cotton. The first commercial production will shortly start coming in from a new plant in Brunswick, Ga. If test results continue to be as promising as those already reported, a substantial expansion in output can be expected before the end of the year.

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For air dusting of crops in North Africa, Claude Mouries, head of "SAPATA" of Algiers recently spent a month in the United States buying a heliocopter and other equipment and materials. This is to augment equipment now used in commercial custom spraying by Mr. Mouries' firm throughout Algeria. Modern agricultural methods and materials are finding ever widening use in Algeria and Morocco. We are trying to convince Mr. Mouries to write the story for us. Who mentioned "dark continent?"

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Entomologists at the University of New Mexico have found that fruit files can survive extreme heights into the ionosphere, according to reports of a recent experiment. A number of flies were included in containers holding instruments and cameras in the warhead of a V-2 rocket launched at White Sands proving ground. The insects, along with the instruments, floated leisurely to earth by ribbon parachute from a height of something like 360,000 feet. The descent required about an hour. The flies not only survived, but seemed none the worse for their experience.

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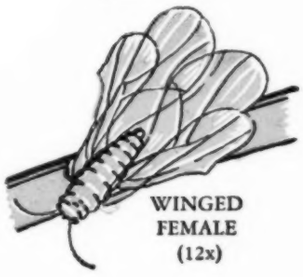
A lot of potential grief is seen in the so-called "accelerated testing" program being shoved through in many quarters of the insecticide trade in order to get materials on the market ahead of competitors. The pitfalls are many and serious in marketing such materials before a complete toxicological study is made. A word to the wise . . . .

PEA
APHID

(Illinoia pisi)



WINGED
FEMALE
(12x)

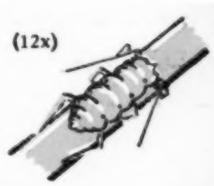
BUG OF THE MONTH

THIS is the insect most feared of all by the large growers and canners of peas. Due to its oviviviparous habits, the young are hatched alive, apparently sexually mature and fertile. When unchecked, its increase is phenomenal. Millions of aphids seem to appear in a matter of days and, sucking the sap from stems and leaves, lay waste whole fields.

Infested peas wilt. Bronzy patches appear in the fields. Because of the small size of this pest, it is often overlooked and the damage laid to more conspicuous insects, or to root rot. Yet, even when the insects are not abundant enough to kill the plants or even to cut the yield appreciably, the quality of peas harvested will often be poor.

Methods of control in general practice today are two—dusting with ground cubé root in a suitable dry-powder carrier, and spraying with a water suspension of the same material.

(12x)



For estimating markets, it is safe to figure 4 to 6 lb. of the active insecticide per acre. In actual control work, the recommendations of local extension agents should be followed to the letter.

In any case, the efficacy of your formulations will depend on uniformly high quality root, with known and dependable rotenone content. For this, you can look with confidence to Prentox Cubé Powder. The uniform excellence of this material has made Prentiss the largest handler of rotenone-bearing roots in the United States. The product is completely fiber-free, and the exclusive milling techniques also result in an extremely fine powder—almost micron-sized—resulting in maximum insecticidal action.

Your inquiries are invited. Our specialized knowledge of insecticide materials is at your disposal at all times —for the development of consistently better insecticides.

R. J. PRENTISS & CO., Inc.

110 WILLIAM STREET, NEW YORK 7, N. Y. 9 SO. CLINTON STREET, CHICAGO 6, ILL.

PRENTOX PEST-TESTED INSECTICIDE CONCENTRATES SOLD TO INSECTICIDE MANUFACTURERS ONLY

FOR THE EXCLUSIVE USE OF INSECTICIDE MANUFACTURERS—SEE PAGE (16 .)

PENICK BASIC INSECTICIDES

"nip 'em in the bud"

Whether they fly, hop or crawl on the plant itself — whether they creep or walk, or run—whether they are grubs, worms or insects, PENICK has an effective basic insecticide, which, when mixed for the particular need, will "nip 'em in the bud."

Continuous tests conducted in our research laboratories prove the potency and toxicity of PENICK insecticidal bases.

PYRETHRUM POWDER: Our product assays .5% to 1.3% pyrethrins. Here is a range suitable to your needs. Many growers prefer it.

IMPREGNO: The pyrethrins are coated on the outside for efficiency and economy. Impregno is a dust concentrate with pyrethrins 2% and reduced by mixture with clay. Sulphur may be used with Impregno and talc if desired or required.

PYREFUME SUPER 20: assays 2 grams pyrethrins per 100 cc. PYREFUME SUPER 40 assays 4 grams per 100 cc. PYREFUME 100 assays 10 grams per 100 cc. All PYREFUME extracts are available in kerosene, odorless petroleum distillate base, pine oil, alcohol and ethylene dichloride.

FOLIAFUME: a combination pyrethrin-rotenone plant-spray concentrate for repackaging under your label. A pre-war favorite—ready to work again.

EMULSIFIABLE PYREXCEL 80: a water based concentrate for the control of soft bodied insects such as aphids, and leaf hoppers. Excellent for greenhouses.

DDT 50% solution for residual spray: 50% dispersible or wettable powder 30% emulsifiable and DDT specialties.

Write for descriptive literature covering our entire line.

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